JANUARY, 1941

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FACTORY

MANAGEMENT and MAINTENANCE

A McGRAW-HILL PUBLICATION

JAN 11 1941

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FACTORY'S WAR COMMUNIQUÉ No. 11 —Page 46

"From contented cows" to grocery counters, milk flows in a steady stream through the plants of the Carnation Company. Any interruption to processing operations may be costly, and so the engineers select equipment with especial care. In their new plant at Statesville, North Carolina, long and maintenance-free stack service was assured by using Byers Wrought Iron. In addition, all underground lines 2" and smaller—steam, water and air—are wrought iron. A wrought iron stack, similar to the one above, was installed at another new plant at Clarksburg, W. Va.

The company has a number of wrought iron stacks in use, some of which replaced stacks of other materials, and so can base selection on first-hand comparative experience. Three wrought iron stacks have been erected at the South Dayton, New York, plant, and one each at the Coshocton, Ohio, Cattaraugus, New York, and Hillsboro, Ohio, plants.

Stacks and breeching are a headache to many maintenance men. If your flue gas conductors require continuous maintenance and frequent replacement, it will pay you to find out the savings wrought iron has made and is making for other engineers in plants all over the country. Our Engineering Service Department will be glad to furnish you with some authentic case histories. Ask, also, for our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment."

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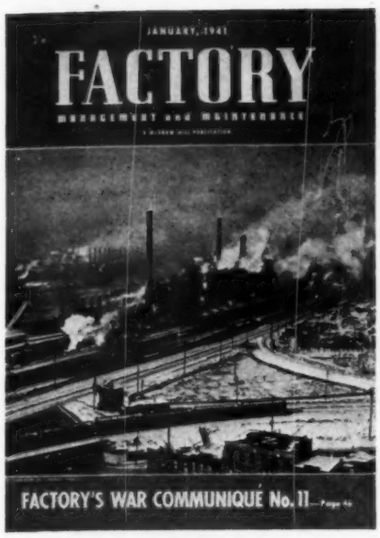

It was 10 degrees below zero when an enterprising young amateur shot this month's full-color cover photograph. It's Pittsburgh, of course. And of course it's steel—the Jones & Laughlin Steel Corporation's works on the north bank of the Monongahela. There are six blast furnaces in this group. Beyond them the 96-in. continuous strip and sheet mill. On the south bank of the river, the Bessemer and open hearth departments, blooming mills, and bar mills.

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FACTORY

MANAGEMENT and MAINTENANCE

JANUARY, 1941

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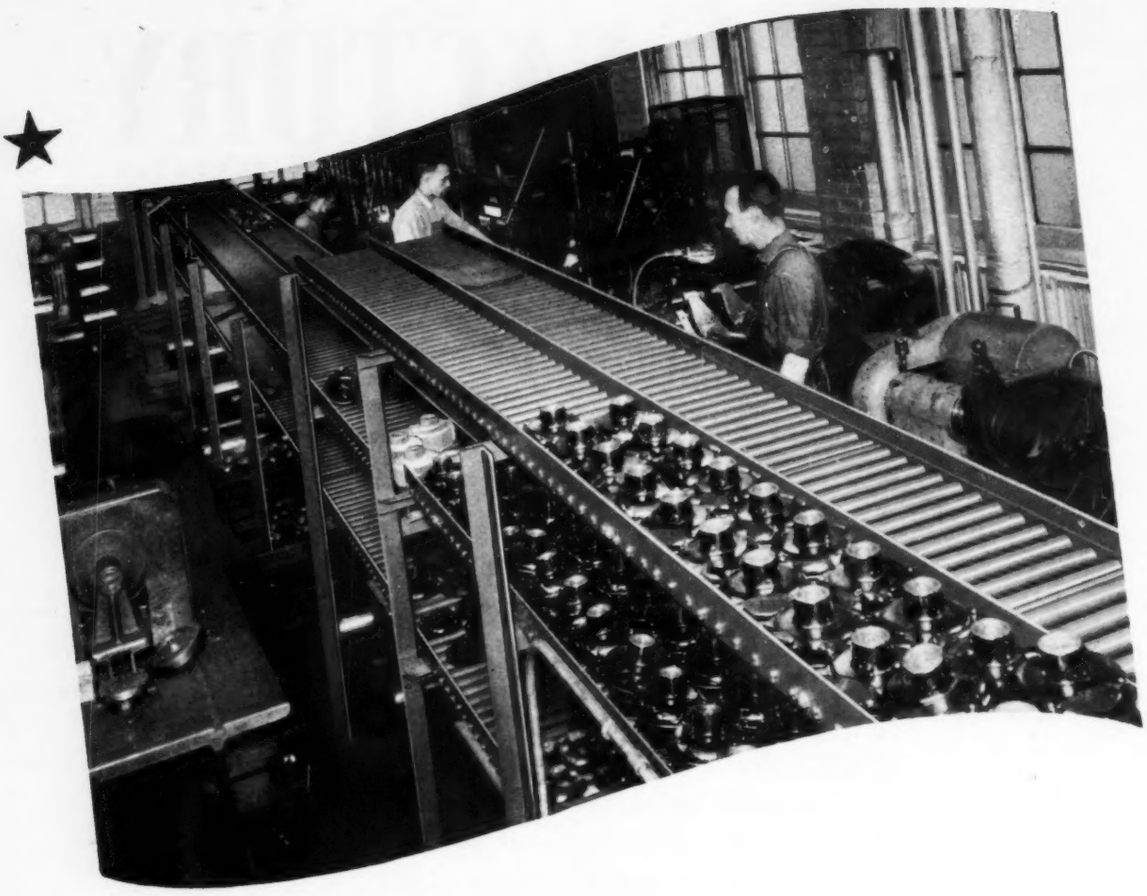

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FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

Defense Speed-Up Must Be Industry's No. 1 Objective

DEFENSE PRODUCTION must be speeded up. Increased production of defense orders must be industry's No. 1 objective, as it must be the No. 1 objective of labor and government. Each of these three principal contributors must share in the increased burden that is ahead.

During the past 30 days it has become public knowledge that production estimates have not been realized. Industry has been blamed, labor has been blamed, government has been blamed—depending upon who was passing judgment.

No doubt evidence could be produced to show that industry is not making full use of its equipment and managerial ability. Likewise, the labor laws could be shown as a deterring factor. And it has taken the government a long time to get around to concentrating authority for defense production. So there is enough blame for all.

Right now, without stopping to fix blame, the job is to achieve the speed-up. Our nation is committed to a program of colossal production for defense. Majority opinion dictates that British defense is American defense, that Britain must have the instruments of war quickly if they are to be effective, and that therefore speed in American production is of the utmost importance.

Government has taken a major constructive step by creating the "Office for Production Management for Defense." Presumably this office, under William S. Knudsen as director, will have authority as well as responsibility. It will advise, but it will also direct.

With this new set-up, there appear to be on hand all the elements for creating an effective nation-wide production control for defense which will operate like the production control system in a single, well-run industrial plant. At the top is an experienced man who knows industry and its production problems. He is in position to control planning and scheduling, purchasing, and inventories of raw materials.

To help this production control system function, industry must find out just where both contracts and sub-contracts can be placed; must see that those plants get orders; and must train the operatives necessary to keep production going on a 24-hour basis for six, or even seven, days when required. In doing so, industry must cooperate in whatever system of priorities it becomes necessary to use, whether mandatory or voluntary, recognizing that defense orders may have to take precedence over the production of normal goods and services.

The increased production must be attained, for the time being, on a basic work week of 40 hours. There can be no doubt as to organized labor's ability to preserve the 40-hour week while there is considerable unemployment, regardless of the extent of employability of the idle. It is probable, though, that labor will have to retreat from its stand that no plant held to have violated the labor laws shall receive a government contract. Public opinion will not stand for what is virtually an attempt to superimpose penalties on those already provided by the labor laws, while the plants involved stand idle so far as national defense is concerned.

By means of plant expansion, overtime work, multiple-shift operation, increased efficiency, and good training programs, industry can give its share of the cooperation necessary to attain its present No. 1 objective of greatly accelerated production for defense. If it fails, it may face drastic changes in our national economic pattern.

L. C. Morrow

We're Going All-Out on Defense

Industry, by cooperating, can avoid drastic controls. Priorities will be first test of cooperation. "Fireside chat" implies their wider use

PROPHECY FOR 1941: Having bared his arm to give John Bull a blood transfusion, Uncle Sam will keep his sleeves rolled up as he hurls himself into a mighty, all-out national defense effort.

That statement virtually exhausts the new year's probabilities in a world in which events have rendered all predictions increasingly vain. But it points to one certainty—*this will be a management year.* Industry's ability to boost production with available equipment and manpower by the greater use of efficient methods and cost-cutting techniques will be tested to the utmost. For upon industry has been placed the triple burden of saving England, re-arming America, and preserving the free American economic system as we know it today.

In the making are two moves of incalculable import to industry:

1. A sensational act of aid to Britain eclipsing anything attempted or discussed so far.

2. A compensatory drastic speed-up of industry that will take, possibly, the form of a Presidential declaration of "unlimited emergency."

This will draw America still closer to the sphere of world conflict, if not to the war itself, and so draw industry closer to centralized governmental coordination—though not necessarily to the semi-totalitarian set-up of the Industrial Mobilization Plan. Everything will depend on the extent to which cooperation may be made to take the place of coercion.

The first big test of the ability of government and industry to cooperate without coercion is under way already —in the field of priorities.

Rather than attempt prophecy in detail, Factory chooses in this report to raise some questions foremost in the reader's mind, together with the comments of well-placed officials and observers in New York and Washington.

War Communiqué No. 11 continues the series of special articles, begun in May, 1938, on the industrial significance of war news abroad and at home. These articles are intended to condense and interpret the sometimes confusing flood of daily events and thus to aid management in evaluating the problems to which these events give rise. Like its predecessor, this article is based on consultation by *Factory* editors (for background only and not for direct quotation) with major officials of the National Defense Advisory Commission, the armed services, and other government agencies. This report was completed January 2, 1941, and therefore subject to reinterpretation in the light of later events

What will we do for England?

Where England is hurt worst, we shall try to help most. Germany is hacking hard at England's lifeline. A U-boat fleet, estimated as high as 180, is sinking an average of three British ships a day, above 300,000 tons a month. Nazi aircraft production capacity, estimated at 5,000 planes a month, is hugely superior to England's and ours combined.

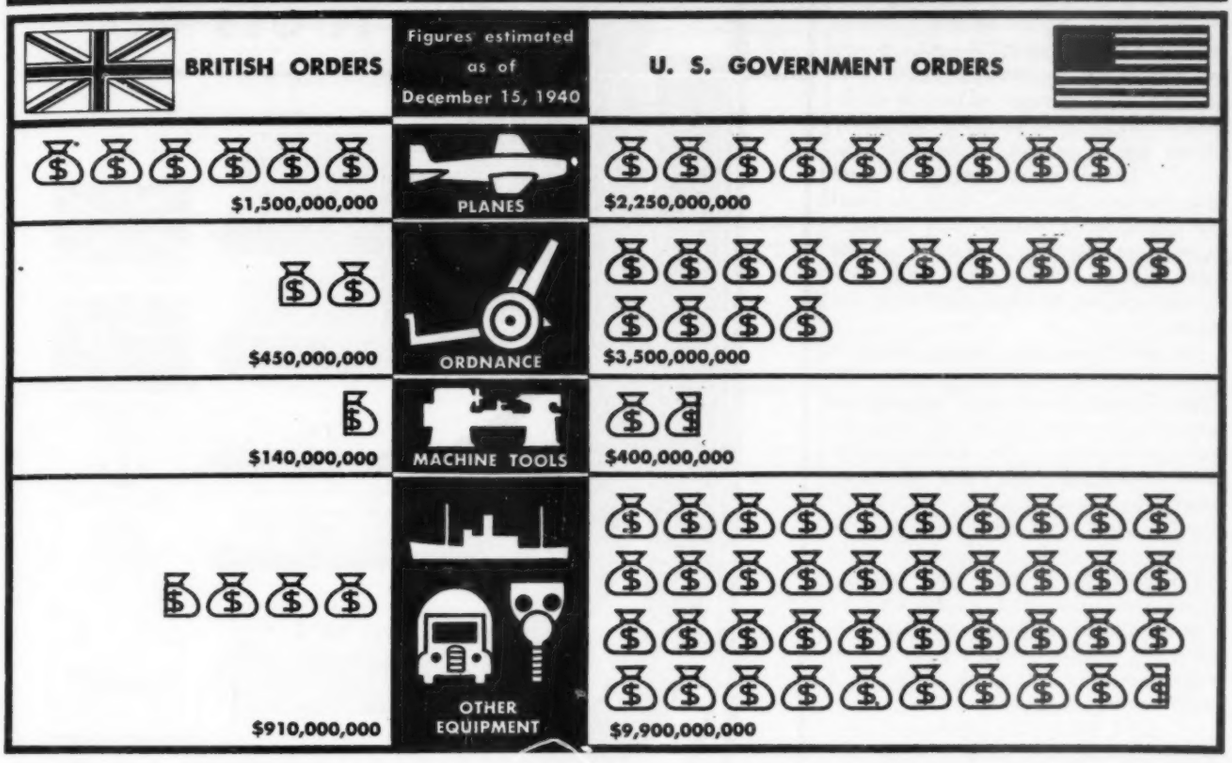
We have warships, although our admirals are loath to part with any more. We have perhaps 6,000 planes, although less than 500 are of the "first line."

To give "all aid short of war" may require a daring, almost desperate gamble of ships and planes. Germany's December 21 warning helped to prepare us psychologically for a gamble. In gambling we shall create an emergency defense situation calling for emergency measures.

What is an unlimited emergency?

It is supposed to coincide with "war or the imminence of war," but the latter is not clearly defined by law. Whenever declared, an unlimited emergency would at once make operative some 100 industrial control laws. Through them the President could, if he chose, license industries, commandeer plants, build plants, operate railroads, airlines, truck and canal transports, control utilities and communications (and commandeer or close radio stations by force, if necessary), requisition ships, fix prices, censor news, and declare priorities in every field, including labor. This

A BIG DOVETAILING JOB



The factors that cause priorities problems are often unpredictable. In 1940 came a sudden flood of British orders totaling above $3,000,000,000. Even more unexpected was the additional $3,000,000,000 of British buying announced late last month. All this must be sandwiched into our own huge program, the brunt of which will fall on industry in the next two years. Formal priorities already operate in machine tools where British buyers sit in on scheduling conferences. U.S. machine tool builders comply voluntarily with requests of Mason Britton, in charge of priorities for the industry. In other fields production plans have been speeded by the "freezing" of designs for tanks and planes, the British accepting our models in order to get quicker deliveries

last could bring about the practical abrogation of existing labor laws and the conscription of defense workers. It could also mean the practical conscription of industrial materials and the confiscation of profits.

A great many of these powers are already in the President's hands, such as the authorization for plant commandeering included in the Overton-Russell amendment to last September's defense bill, and the priorities provisions of the June 28 bill. But for scope of action, as well as for public and diplomatic effect, a declared emergency might be more effective. Moreover it might in operation reveal whether we need to move closer to—or can stop short of—the full Industrial Mobilization Plan.

How would the IMP differ from an emergency defense situation?

To begin with, it is totalitarian in concept and wholly coercive in spirit. Industry and the individual are alike subservient to its dictates. It is war.

Let us say that today there is a defense chief, Mr. X. (Yesterday there wasn't even that.) Tomorrow, under a declared emergency, Mr. X, who might or might not be William S. Knudsen, assumes the broad powers vested in him as the President's agent by the 100 laws mentioned above. Now he doesn't have to plead with anybody. Actually, he tries to get voluntary cooperation. Especially if he *is* Mr. Knudsen, he prefers to "prod" people rather than punish them.

Now comes M-Day, the theoretical first day of war. The IMP goes into effect. Mr. X becomes War Resources Administrator, minister plenipotentiary over industry, agriculture, and everything else. He is required by the very nature of the Plan to be a "czar." He is assisted by lesser Mr. X's, each the sole administrator of something. They supplant or take over existing government boards and bureaus. They declare priorities, fix prices and wages, move industries and men about like pawns on a chessboard.

About all Congress does is pass confiscatory tax laws and new measures to regiment industry. An example would be the Industrial Management Act, a sample draft of which was included in the 1936 version of the Industrial Mobilization Plan. This would permit the government to take any management man—yourself, for example—out of his job and put him to work in a government job, possibly running somebody else's commandeered plant. His salary would be fixed by the government. If he accepted compensation from any other source, he would go to jail, pay a $10,000 fine, or both.

If that sounds like Germany, it may be because the Industrial Mobilization Plan has reputedly been copied by Germany. All this drastic dictatorship may never happen here, of course. We may never go to war. Even if we do, we can avoid totalitarianism by demonstrating meanwhile that we can beat the dictators at their own game on a voluntary, cooperative basis. There are many in authority who believe this will be done. (*Continued on next page*)

What's on the minds of those men in Washington?

Even when the "terrible urgency" of our defense lag moved him to strong speech, Knudsen said: "Despotic power we abhor, but we must recognize that it compels the exercise of certain qualities which we must exercise voluntarily if we are to prevail in time of conflict." His later statements indicate that "certain qualities" mean national discipline for both labor and management, less attention to profits on the part of both, harder work, and more production per machine, per man, per plant.

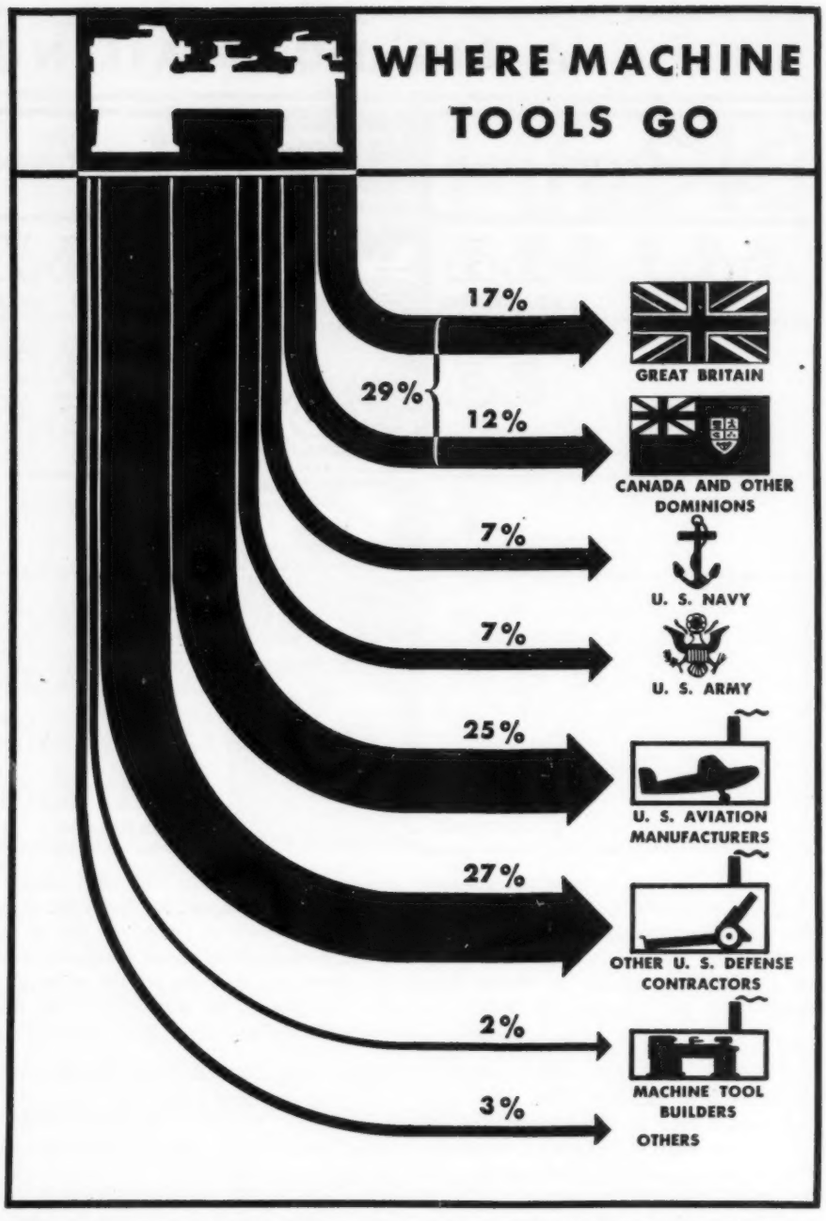
In mid-December, before Knudsen cleared the air, many of the other Defense Commissioners were secretly exasperated by the whole national attitude on defense. The leading industrialists among them were no more ready to excuse management than labor.* They condemned equally the tendency of certain companies to fight off expansion or linger over contract price negotiations and the tendency of certain unions to boost military construction costs and of others to oppose expansion in industries where they held tight control of jobs.

A good many commissioners were becoming dubious about "guns and butter." They thought the phrase too complacent and felt the public needed waking up. They wanted executive leadership in the commission and a clearer definition of America's role in world affairs. The Knudsen speech helped a lot. President Roosevelt, the one man in a position to define the national attitude and arouse public opinion, then returned from the Caribbean with the stage all set for an announcement of signal importance. But his statement left most of the real criticisms of defense unanswered. The appointment of the new four-man superboard (Secretaries Stimson and Knox, Defense Commissioners Sidney Hillman and Knudsen) was, as Herbert Hoover put it, "a step in the right direction" to the extent that it gave Knudsen executive authority in the commission. But the exact nature of our next big national move still remains to be seen, as does the exact manner in which we will go all-out on defense.

In his December 29 "fireside chat," the President did reverse the earlier Administration view on "guns and butter" by stating clearly that the guns came first. No longer hopeful of superimposing defense on existing production facilities, he called for widespread plant expansion. He then strongly indicated the further application of priorities by saying that if luxury and consumer goods production were to stand in the way of defense, the former would "gladly yield."

Significantly there was *no* talk in official circles of plunging full tilt into the Industrial Mobilization Plan. Senator Taft of Ohio is about the only person of importance in the government who has advocated the IMP's immediate use. In London, on the other hand, the *Financial News* observed that we could not expect to accomplish much without the "national controls so necessary for a full war effort." General Hugh S. Johnson declared that "this crisis requires something very close to the War Industries Board model of industrial control."

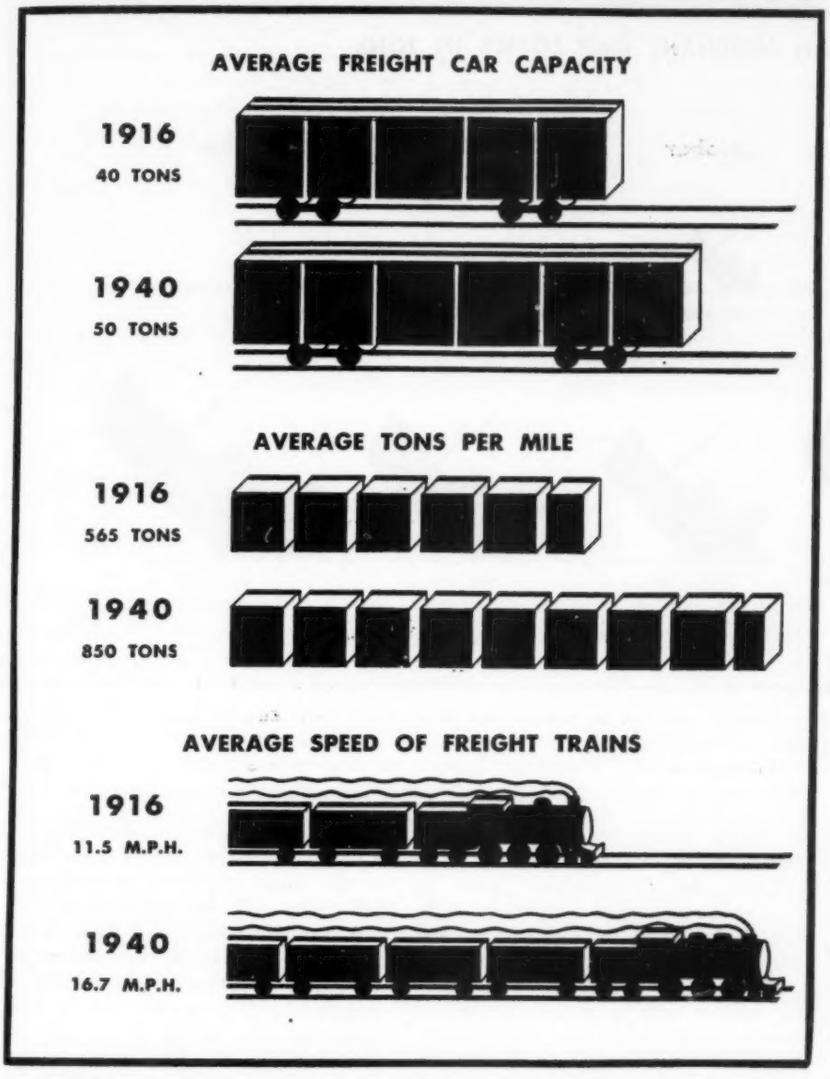
Nevertheless there is no disposition to crack the whip over industry among Army and Navy officers, Defense Commissioners, or even in Administration circles. The prevailing hope is that we can achieve an all-out speed-up by, as Herbert Hoover suggests, "working our machines and heads harder" through a system of "definitely nation-wide organized cooperation."



The machine tool industry's output is now almost entirely devoted to U.S. defense and British war purposes. A typical Ohio company's orders are analyzed in the chart above

* Once in the government service, business men and industrialists readily acquire a government point of view. This has been noted in business men elected to office, and it is becoming evident in the Defense Commission. At the same time, some of the career public servants in the Commission seem to have acquired a more realistic attitude toward industry.

THE RAILS ARE READY



A big World War priorities headache is solved if railroads are right in saying they're "ready for anything." With fewer but larger freight cars and fewer but speedier locomotives, the carriers last year hauled more freight than in 1916—a perhaps comparable pre-war year. In World War jam-up, an average 200,000 cars lay in the terminals waiting to be unloaded. This time, the railroads say, no car will be dispatched unless its destination and unloading date are assured in advance. Two-thirds of our freight still goes by rail. Truck fleets, waterways, and pipelines will also help to ease the load

Priorities bring the noble word, cooperation, down to brass tacks. They represent the first big step toward the war economy. Either they are accomplished by industry's voluntary compliance or they are enforced by law.

What are priorities?

Major Frank W. Gano, in an Army Industrial College study, defines them as "purposeful discrimination which has for its aim effective control of industrial production and distribution in order to promote the successful conduct of war."

In everyday language, a priorities system is a sort of industrial traffic cop. It gives the green light to war goods and waves normal goods to a halt whenever the two seem about to collide. Examples:

X Company, which makes toy trains, wants to buy brass. *Y Company*, which makes military cartridges, also wants brass. There is not enough brass for both. By order of the government, *Y* gets the brass.

Z Company has orders for both war goods and peace goods. It is told to schedule production of the former ahead of the latter. If it has orders for several sorts of war goods it is told which to finish first.

Priorities in wartime? This from *The New York Times* of December 22:

"This year the famous Christmas market in Berlin's Lustgarten was not held. The goods it once sold were not to be had."

Priorities *can* be voluntary. It is better to keep them that way. But some manufacturers will defy or evade them; some consumers will complain. This from "Germany's Economic Mobilization for War," a National Industrial Conference Board study:

"Propaganda was skillfully and unceasingly used to persuade the German people to accept sacrifices *and for those whose sense of duty was deficient, punishment was swift and harsh.*"

In this country, compulsory priorities are universally feared by management, by labor, by economists, and by government. They work hardships and cause unemployment in the non-defense industries. They are invariably followed by their even less welcome handmaiden, price control.

What about priorities in 1917-18?

Much of the modern dread of priorities springs from the memory of priorities *wrongly applied*, as they were early in the World War. Then any number of government agencies, the War Department, the Navy, the Shipping Board, and so forth, had the power to "red ticket" their contracts. They were bidding against each other and scheming madly to get prior delivery.

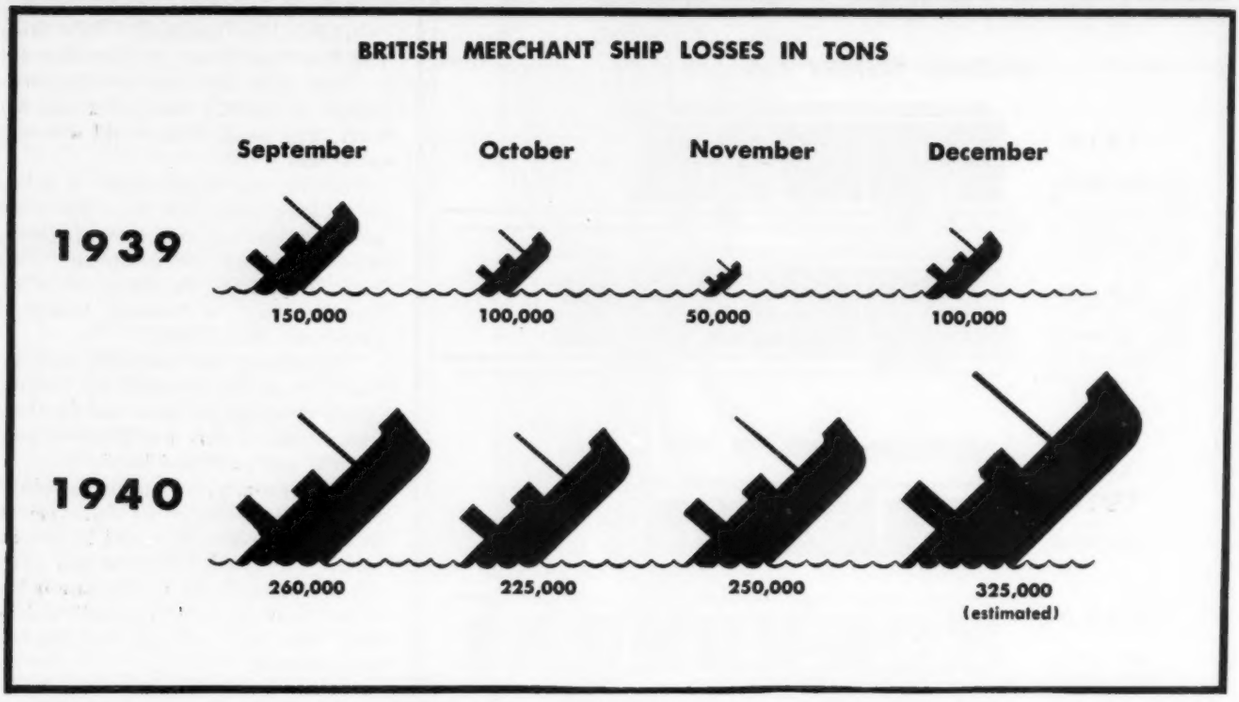
The results were chaos, spiraling prices, deplorable delays. Freight yards and shipping ports were hopelessly congested. Trains were often unloaded in the fields 20 miles from the terminals. *Fully 85 percent of the cars in the yards bore priority tags.*

Every industry and every company that could afford a lobbyist demanded preferential rating and usually got it. At the heart of the mess was the struggle for transportation priorities. Idle miners waited at the coal mines for trains that seemed never to come while idle industries waited in vain for coal.

"As late as February 1918," says Charles O. Hardy of the Brookings Institution, "steel plants were operating at only 33 percent of capacity for lack of coal while at the same time coal was being delivered to breweries and saloons."

Not until late that year did the War Industries Board restore order by set-

ONE REASON WHY BRITAIN NEEDS HELP



Germany is hacking hard at England's lifeline. U-boats now sink an average of 3 British ships daily. England needs help at sea and in the air. A U.S. gamble of ships and planes in Britain's aid will create an emergency defense situation. Will we then move closer to—or stop short of—the Industrial Mobilization Plan? Everything depends on cooperation of government and industry

ting up a centralized priorities control system freed of favoritism and keyed to the nation's needs. By that time the most drastic and dictatorial measures were necessary. Had the war continued through 1918, the automotive industry would have been shut down completely.

How is the priorities problem being handled now?

First of all, remember that the whole initial philosophy of defense was to superimpose efficient production on the normal national economy. Then, it was hoped, general production would expand until the unemployed were fully reemployed and only then would formal production controls be needed.

The Defense Commission's strategy on priorities, therefore, has been one of prevention. The objective has been to anticipate chokepoints and build up stockpiles or expand production as the need might be foreseen. It was recognized from the start, however, that some priorities might be needed to carry industry over the peaks of demand. Then "purposeful discrimination" was to be used—but only on a voluntary basis and only in the field in which the shortage occurred—until the augmented stocks or production facilities could take hold.

Thus the Commission hoped to achieve an expanded production without dislocations, without price and wage inflation, and without coercive controls. The ultimate aim: to leave the nation with a sound, productive economy that could face the competition of the totalitarian powers in the post-war world market.

What priorities are already in effect?

First of all, the Army and Navy Munitions Board has a priorities committee which gives preference ratings to different items of munitions. No ordinary commercial goods are involved. These priorities are on a voluntary basis. The manufacturers are requested, but not compelled, to comply. However, they are reminded that legal means of enforcement exist in the June 28 law.

The preference ratings include ten classifications from A-1-a (machine tool builders' supplies for defense work only) through A-1-b (bombsights, .50 caliber aircraft machine guns, small arms, etc.) to A-1-j. They are meant primarily to insure contract delivery dates. They serve chiefly as a guide to the large munitions manufacturer with many different orders on hand.

A significant feature of these ratings is that they also apply to sub-contracts for parts. (Raw materials are not yet included.) Let us say that a large munitions firm has an A-1-c order for aircraft radio apparatus. From a plastics molder he orders panels, making the contract "A-1-c". The plastics firm also has a contract for instrument panels for aircraft frames (A-1-b). He tries to schedule his work so that both orders are ready on the delivery date, but if one has to wait, it will be the *c* item.

This is priority in a limited form. The Army and Navy Munitions Board can determine which military goods should be finished first. But it cannot determine priorities as between other government departments, essential commercial requirements, and foreign orders. Consequently, the broader application of priorities belongs with the Defense Commission, especially if compulsory priorities should become necessary. This broader type of priority has in fact been assigned to the Commission's jurisdiction and is already in effect in two industries, machine tools and commercial aircraft.

Who makes the big priorities decisions?

For policy making, the Commission has a Priorities Board and for operations a Priorities Administrator. As the need arises, priorities committees will be set up for chokepoint industries with an administrator for each committee. Donald M. Nelson, who is also the Commission's coordinator of procurement, is the major Priorities Administrator.

The machine tool industry had a volume of $20,000,000 in 1932, $400,000,000 in 1940, and a probable $650,000,000-plus this year. Its products are vital both to defense and peace-time industry. The aircraft industry employed 41,000 persons in 1938, employs 200,000 today, and expects to employ 550,000 by fall. It is not surprising that the need for priorities should develop first in these two industries.

Priorities Administrator of Machine Tools is Mason Britton, who is also in charge of the machine tool, heavy ordnance, and optical goods sections of Knudsen's staff. One of Britton's first big problems is scheduling. Aircraft engine plant *A* has just been completed and is about to go into production. Aircraft engine plant *B* has just broken ground for a new building and will not be ready to operate for several months. Both have ordered machine tools for immediate delivery. Good scheduling dictates that these tools should be speeded to *A* who can use them at once. When *B* is ready to operate, some months hence, it will get tools ordered by some unfinished plant *C*.

Machine tools are already about as thoroughly rationed as the products of a single industry are ever likely to be. Ninety-five percent of the next ten months' production is definitely assigned to defense purposes and British use. Exports to nations other than Great Britain have been virtually shut off. Allocations as between the British, who have come into the market with heavy new orders recently, and American buyers are settled at round-table conferences. Mr. Britton presides with representatives of our Army and Navy and the British and Canadian Purchasing Commissions present. In some cases the British have readily conceded priority to American orders. In other cases they have been given preference.

Every prospective purchaser of machine tools who visits the Defense Commission is encouraged to go forth and try to discover new sources. Further expansion of the industry meanwhile proceeds apace. And the hunt goes on for machine tools "standing around in boxes" as might be the case in the unfinished aircraft plant *B*.

While still formative, machine tool priorities are the furthest advanced of any. They are doubly important because they may be setting the pattern for priorities in other industries in the future and *because they are entirely voluntary*. The machine tool industry has won the admiration of official Washington by its ready cooperation with the Commission and has thus done all industry a service in establishing that the priorities job can be handled without compulsion.

WHAT THE ARMY AND NAVY WANT FIRST

Ten classifications of preference, from A-1-a to A-1-j, have been set up by the Priorities Committee of the Army and Navy Munitions Board. These ratings are meant chiefly to guide munitions manufacturers in scheduling government orders and thus insure delivery dates. They are not compulsory.

If a manufacturer has contracts for both 50-calibre aircraft machine guns (A-1-b) and anti-tank guns (A-1-g) he schedules the first ahead of the second. If he issues subcontracts for parts for an item marked A-1-b, the subcontractor's order will also be marked A-1-b and will be given the same preference in the subcontractor's plant. As yet these preference ratings do not extend to raw materials.

Only about 10 percent of U. S. war orders are covered by these preference ratings which govern non-commercial munitions items only and do not include any Quartermaster Corps orders. Here are a few typical items from each of the classifications:

A-1-a

Machine tool builders' supplies for defense tool makers

A-1-b

Bombsights, 50-calibre aircraft machine guns, plant equipment for naval vessels to be completed in 1941, also mines, nets, minesweepers

A-1-c

Aircraft engines, propellors, armor and turrets, radio apparatus

A-1-d

Airframes, surgical instruments, 30-calibre aircraft machine guns, aircraft pyrotechnic pistols

A-1-e

Aircraft bombs and pyrotechnics, equipment for optical industry

A-1-f

Anti-aircraft and underwater protection for merchant ships, other anti-aircraft equipment, 60-mm. mortars

A-1-g

Combat vehicles and accessories, anti-tank guns, airfield construction

A-1-h

Mobile artillery and equipment

A-1-i and A-1-j

Clean-up categories for items not mentioned in previous ratings

If, later, preference ratings are applied to defense orders for commercial goods, these are the items considered by the War Department most likely to receive preference: Motor vehicles, tool sets, blankets, service shoes, working suits, underwear, field lanterns, radio vacuum tubes, flashlights, signal panel sets, camouflage equipment, topographical equipment, barbed wire coils, aircraft cameras, pneumatic rafts, flying jackets, and parachutes.

Where are future priorities problems most likely to occur?

"You can't tell where a balloon is going to bulge until you poke it," says Nelson. Between June and September of last year, we blew up a big balloon of $16,000,000,000 in defense orders and authorizations. Came the British with another $3,000,000,000 in orders to enlarge the potential problem.

It seems agreed that the impact of defense production will not be felt heavily in industry until May and will not hit its peak until August. Meanwhile, the Defense Commission and Army and Navy industrial research staffs are hunting studiously for probable bulges. No one knows just where they may occur.

"A year ago we were pretty sure airplane frames would be a major bottleneck," one Army officer who is a shrewd student of industry remarked. "Instead

it turned out to be engines." Another factor of uncertainty is the suddenly announced new $3,000,000,000 of British buying which began last month. Some military requirements have been changed unexpectedly by events abroad. For example, the 75-mm. gun, long a standard American artillery weapon, has about been pushed out of the picture since our military observers in the French campaign reported that it lacked the fire power to cope with new types of armorplate on heavy tanks. We have spent many millions of dollars modernizing old World War 75's, but the new 105-mm. howitzer will replace them.

As nearly as can be foreseen, priority problems may arise in zinc (where smelter capacity is already being expanded), alloy steels, gages (four companies are expanding capacity), 100-octane gasoline, aluminum forgings, manganese, optical goods, and toluol (where new capacity is also being developed).

Army and Navy demands are already taking precedence in synthetic rubber, important because of its oil-resistant qualities in the making of washers on artillery index gages and the linings of self-sealing gasoline tanks for airplanes. There is a good, lively argument going on about steel, now running at 97 percent of capacity, with two strong schools of thought for and against expansion. The probable total of all American and British defense requirements will not absorb over 15 percent of the industry's production. But the odds are that very extensive expansion will take place. As for copper, a potential bulge was headed off not long ago by a temporary tariff cut.

Even in an all-out situation, the Commission seems resolved to fight on against the broad adoption of priorities and especially against "blanket" priorities for whole companies and industries, one of the most serious evils of the early World War days. With industry's cooperation, the Commissioners believe they can succeed. One way in which industry can cooperate, they say, will be by *not* rushing to Washington to demand preference on the slightest pretext.

Fortunately the two main priorities problems of the World War, fuel and transportation, seem safely out of the picture today. The Association of American Railroads is absolutely confident of the carriers' ability to meet any emergency with fewer but more capacious freight cars, fewer but stronger and faster locomotives, and better scheduling. In the World War there was an average of 200,000 loaded cars lying in the yards at all times. The Association's slogan today is "Cars for transportation, not for storage." It will not permit a car to be dispatched unless unloading at destination has already been scheduled.

Wanted—good ideas for speeding up industrial defense production. Eligible—any bench worker or foreman in the metal working industries. Reward—$10,000 in prizes. In this way one American company, Revere Copper and Brass, sponsor of the award, promotes national unity by inviting U.S. labor to pitch in with minds and hearts as well as hands

This is one of two extremely hopeful factors in the priority picture. Another is the amount of planning that has been done by the Army and Navy by contrast with World War days. Nothing was known then about sources of munitions. Today nearly 85 percent of our defense orders have moved down the channels marked out for them by the War Department Planning Branch's long-continuing surveys of the potential capacities of 10,000 plants. There is even a sort of rough scheduling in the delivery dates of the contracts that went out between June and November.

Summary

The coming "all-out" defense effort will place upon industry the gigantic, but by no means impossible, task of producing more and more under certain emergency handicaps. Good management will come to the fore in the new year as a vital factor in keeping our economy on an enterprise basis.

Facing facts, there seems little likelihood of immediate change in existing labor laws and government restrictions on industry. Labor's strength is equal to management's in the government, and unless the unions fall out of favor with the public—which may happen—they will hold their present gains. Both management and labor may find the basis for a more moderate attitude in the new year. In any event, one of management's chief responsibilities, good labor relations and public relations, will deserve closer attention than ever before. Industrial statesmanship will call for voluntary compliance with priorities. Alert managements will redouble all efforts to hold down prices and inventories, to cut costs, to utilize machines, wherever needed, on a three-shift, six-day basis, to stress maintenance and avoid breakdowns, to increase research activities.

"As events take shape, as possible adoption of the Industrial Mobilization Plan draws nearer, the growing importance of the National Defense Advisory Commission tends to place the direction of the defense program in the hands of private enterprise," said an earlier FACTORY war communiqué, July, 1940. "And Mr. Knudsen, Mr. Stettinius, and the others are, in the opinion of the best-informed observers, the very men to keep it there."

Industry finds in 1941 an opportunity to *keep them there* and thus avert the more serious development of compulsory economic controls.

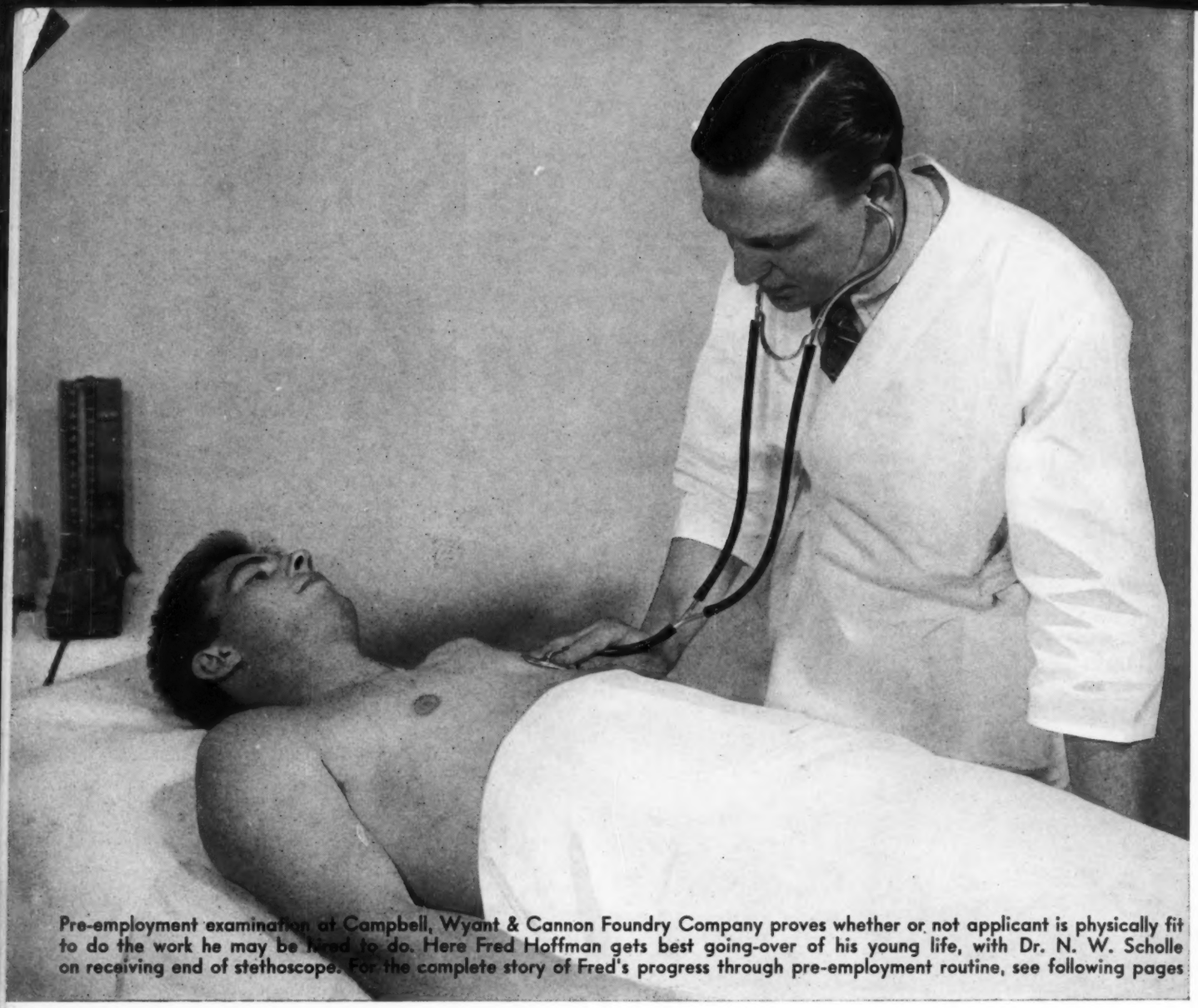
HEALTH *and* SAFETY

for greater national production

America's industrial wage earners will, in the last analysis, turn out the guns and tanks and planes for defense, produce all the other goods needed for good living. On their continued health and safety must stand or fall the greatest production program our country has ever undertaken

JANUARY, 1941

FACTORY MANAGEMENT and MAINTENANCE

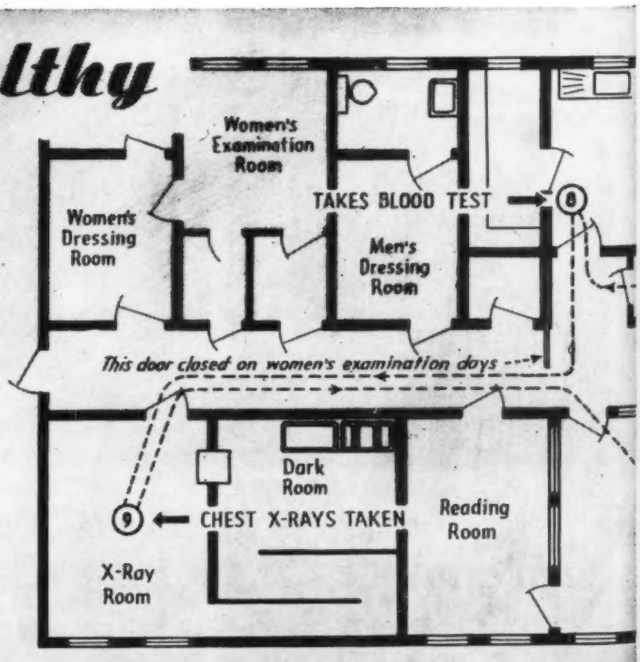


Pre-employment examination at Campbell, Wyant & Cannon Foundry Company proves whether or not applicant is physically fit to do the work he may be hired to do. Here Fred Hoffman gets best going-over of his young life, with Dr. N. W. Scholle on receiving end of stethoscope. For the complete story of Fred's progress through pre-employment routine, see following pages

Starts Healthy Workers,

Keeps Them Healthy

HEART OF THE HEALTH PROGRAM is pre-employment exam (above), followed up annually or oftener, depending upon the nature of the work, by complete physical check-ups. To demonstrate how a health service can be organized in a not-too-big concern, FACTORY pictures effective yet unpretentious set-up at Campbell, Wyant & Cannon Foundry Company, 2,000-man plant at Muskegon, Mich., and well-known supplier of motor blocks to the automotive trade. Right, dotted line on floor plan marks new man's progress through employment, examination, X-ray departments.



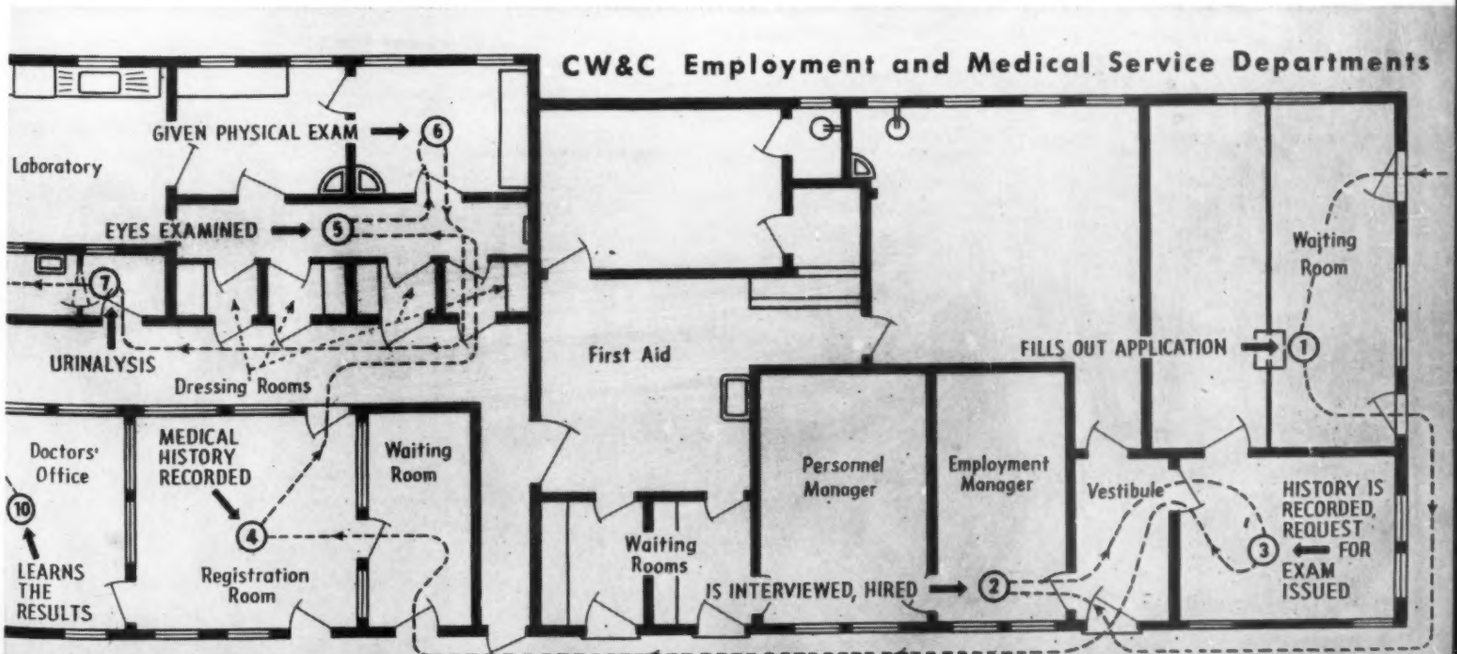
Dotted line on floor plan marks Fred Hoffman's

Employment Manager C. J. Van Dam interviews likely-looking prospect, hires him

Fred Hoffman Applies

REDUCING the CW&C health story to simplest terms, FACTORY's editors went into the shop, pulled Fred Hoffman off his castings inspection job. Actually, Fred is a CW&C employee of 18 months' standing. Here we see what happened to him the day he was hired—and what happens to every new man in this health-conscious plant. Factory work may in our defense program call for increasing expenditures of energy. CW&C policy is, as every plant's should be, to start healthy workers, keep 'em healthy.

Harold Workman of employment office records Fred's history, issues request for exam



progress as he retraced for FACTORY the steps he took the day he was hired

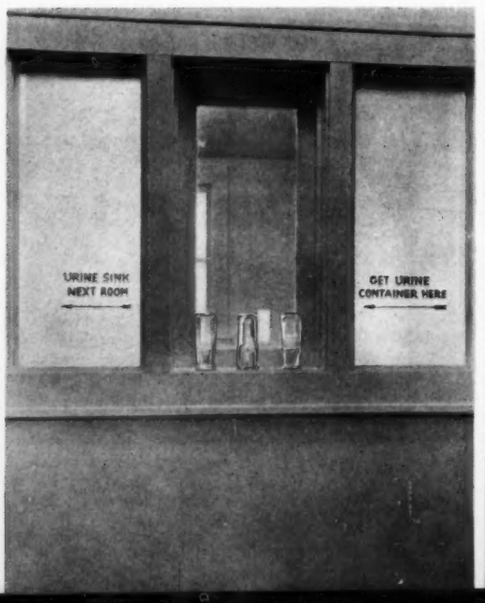
(CONTINUED ON NEXT PAGE)

Fred Takes His Physical Exam

ONE MORE preliminary—the recording (below) of his medical history—and young Hoffman is ready for the physical exam (shown out of normal sequence on a preceding page). The history is important as a guide to present physical condition. Fred then strips and is examined from head to foot. Doctor looks for skin diseases, hyperthyroidism, chronic bronchitis, bad teeth, barrel chest, varicose veins, hernia, foot troubles, etc. Eye and ear check-ups, urinalysis, Kahn test (for syphilis), and chest X-rays follow. Applicants are rejected on physical grounds only when employment would make them a menace to themselves or to others. CW&C medical staff consists of two nurses (one for each of two plants), technician, night first-aid man (a registered pharmacist), examining physician (full-time), medical director and surgeon (in every day for two hours or more).

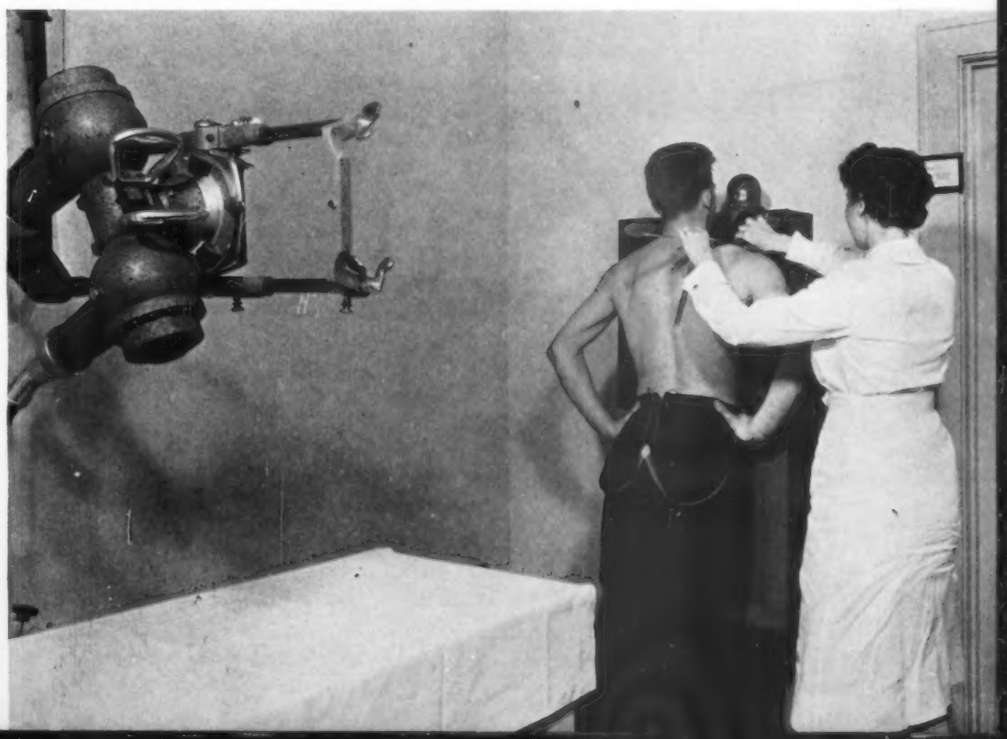
Just before young Hoffman strips for his physical examination, medical clerk Johannes De Horn records his medical history and takes his temperature. Previous medical history is a valuable guide to a man's present physical fitness

Fred gets dressed, has his eyes and ears tested, is weighed. Urinalysis follows. Simple directions expedite the work



Technician Ellen Pease takes a sample of Fred's blood. Every new employee must take the Kahn test for syphilis

Below, left, laboratory technician puts sample of blood in centrifuge used in making the Kahn test. Right, she places Hoffman in position for chest X-rays. All questionable cases of tuberculosis, as revealed by X-ray and physical examinations, are put in care of tuberculosis clinic, while those found to be active are weeded out according to state law



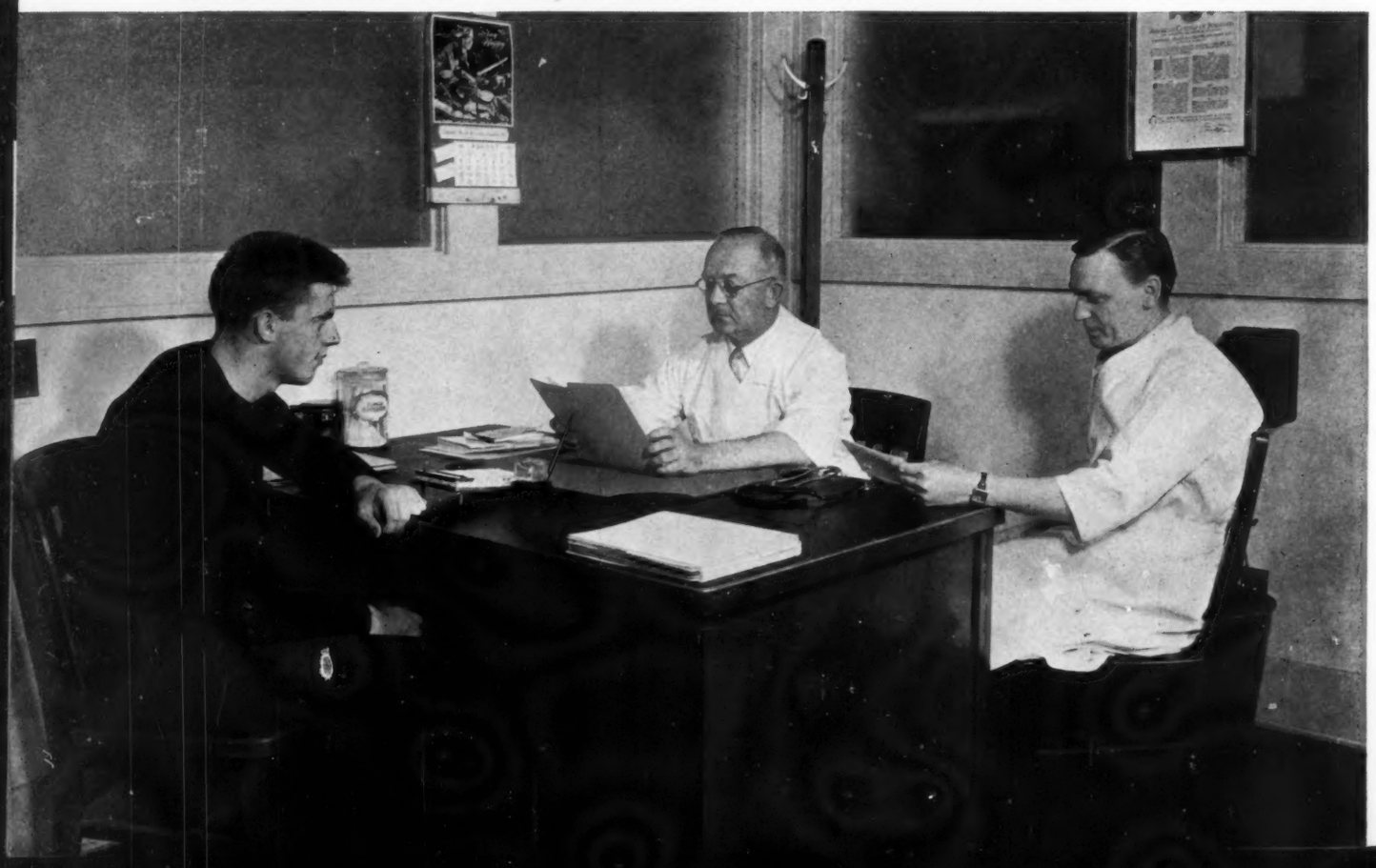
Fred Learns Verdict

YOUNG HOFFMAN has now come to the very last stop on his trip. The doctors have checked his chest X-rays. Fred sits down with them, learns the verdict.

To facilitate the placing of men and their selection for re-examination, CW&C has evolved a system of classification which places applicants in one of five classes. Examiners take into account not only applicant's present physical status, but also probability of his maintaining this capacity in years to come.

What does all this cost? By its industrial health service program, CW&C has cut net insurance expense from $3.02 to 88 cents per $100 of payroll. Medical expense amounts to about 55 cents per $100.

Above, Dr. C. M. Colignon, medical director, and his assistant, Dr. Scholle, check Fred Hoffman's chest X-rays and dictate their findings to the laboratory technician who doubles as secretary. Below, Fred sits down with the two doctors and discovers there is nothing the matter with him. On section cover, Carol Baker, R.N., renders first aid



Dr. Glenn S. Everts dresses finger at E. Hubschman & Sons, one of five plants whose health programs he conducts

Five Small Plants Do the Health Job Together

"BUT WHAT CAN THE SMALL PLANT DO ABOUT IT? I mean the one with a couple of hundred people?"

Whenever plant operating men foregather and the discussion veers round to employee health, some fellow is dead sure to toss that one into the pot.

Not that it's the bombshell he thinks it is. The small plant most certainly *can* do something about it.

True, most small plants cannot afford, perhaps do not even need, complete medical service with full-time physician, full-time nurse, and trimmings. But they *can* have a doctor on call and a part-time nurse. Or, better, a full-time nurse who turns to and helps out on other jobs in whatever time she has left over from her nursing duties. Either of these arrangements is better than no medical service at all. Trouble is, neither provides for preventive medical practice in the plant.

Which brings us to the third way—and the subject of this article. It is to have a doctor trained in industrial health problems provide curative and preventive medical service in a group of small factories within a given industrial area. One such plan is working in Binghamton, N. Y. Another in Toledo. A third in Philadelphia.

To describe the Philadelphia set-up is to describe the technique employed in all such plans. It operates somewhat as follows:

Five concerns, ranging in size from 100 to 500 em-

COST OF MEDICAL CARE TO FIVE SMALL PHILADELPHIA MANUFACTURERS

Name of plant *Number of employees*	*Plant A* *100*	*Plant B* *350*	*Plant C* *278*	*Plant D* *550*	*Plant E* *690*
Cost of drugs and supplies per month.....	$20.00	$25.00	$40.00	$35.00	$50.00
Doctor's salary per month.....	$52.50	$50.00	$120.98	$52.00	$102.60
Nurse's salary per month.....	$20.98	$55.08	$55.08	$155.00	$115.41
Total cost per month.....	$93.48	$130.08	$216.06	$242.00	$268.01
Cost per man per year.....	$11.21	$4.46	$9.33	$5.28	$4.66
Doctor in factory, hours per week.....	3.0	7.25	7.25	3.92	6.0
Nurse in factory, hours per week.....	4.00	8.0	10.5	44.00	22.0

ployees, are served by one physician, Dr. Glenn S. Everts. They are the Fleer Gum Corporation, 100 employees (designated as *Plant A* in the table); a large baking company that manufactures cakes and cookies, 350 employees (*Plant B*); Ketterlinus Lithographic Manufacturing Company, about 275 employees (*Plant C*); E. Hubschman & Sons, a tannery with 550 people (*Plant D*); and F. G. Vogt & Sons, pork packers, 690, (*Plant E*).

Note that the five plants are all in different industries, each presenting its special health problems. For instance, the U. S. Department of Labor lists no fewer than 29 occupational hazards in lithographing plants. In the tannery there is the danger of chrome sores, lime burns, dermatitis, also a heat problem. In the pork packing plant changes in temperature may affect employees' health. And so on.

In each plant there is an examining room and a treatment room. Each has a part-time registered nurse (except the tannery, whose nurse is on full time) supplied by the Visiting Nurse Society. Each nurse has a trained substitute who is ready to take over the job at any time. Any concern may buy up to half the time of VNS nurses if a doctor is on service to supervise them. Doctor's and nurses' hours per week are shown in the table.

But let's walk in on Doctor Everts during a call at the bakery and see what it's all about. He visits this plant daily. So does the nurse.

Doctor's and nurse's visits overlap every day but Tuesday. Thus they may spend some of their time on joint projects. The nurse can come at the odd hours indicated in the schedule because she spends the rest of the day making home calls for the Visiting Nurse Society.

There is a third member of the medical staff at this plant—a full-time first-aid girl. She was taken off the production line, after showing a liking for the work, and trained to assist the nurse when she's there, carry on when she's not. The set-up is similar in the other four plants, except that the tannery's nurse, as previously noted, is on a full-time basis.

What do doctor and nurses do? Briefly, these things:

1. Make pre-employment examinations in bakery and gum plant, examine within a week in others.

2. Make periodic re-examinations—every year in gum plant, every two years in the tannery, every 2½ years in the lithographing plant. (None in pork packing plant.)

3. Take care of all minor accidents.

4. Provide medical first-aid for any employee who is not too sick to work, but steering clear of the family doctor's province.

5. Direct employees to proper medical sources for correction of chronic illnesses.

6. Work out procedure for the care of employees who have serious accidents; finish the job for ambulatory cases, do the redressing after patient is back to work.

7. Inspect plant every two months.

Paperwork is complete, yet simple. It consists of (1) individual physical examination record, (2) daily report made by nurse to VNS, (3) monthly dispensary report made by VNS to each plant, (4) annual report by VNS to plant, (5) periodic report by doctor to plant.

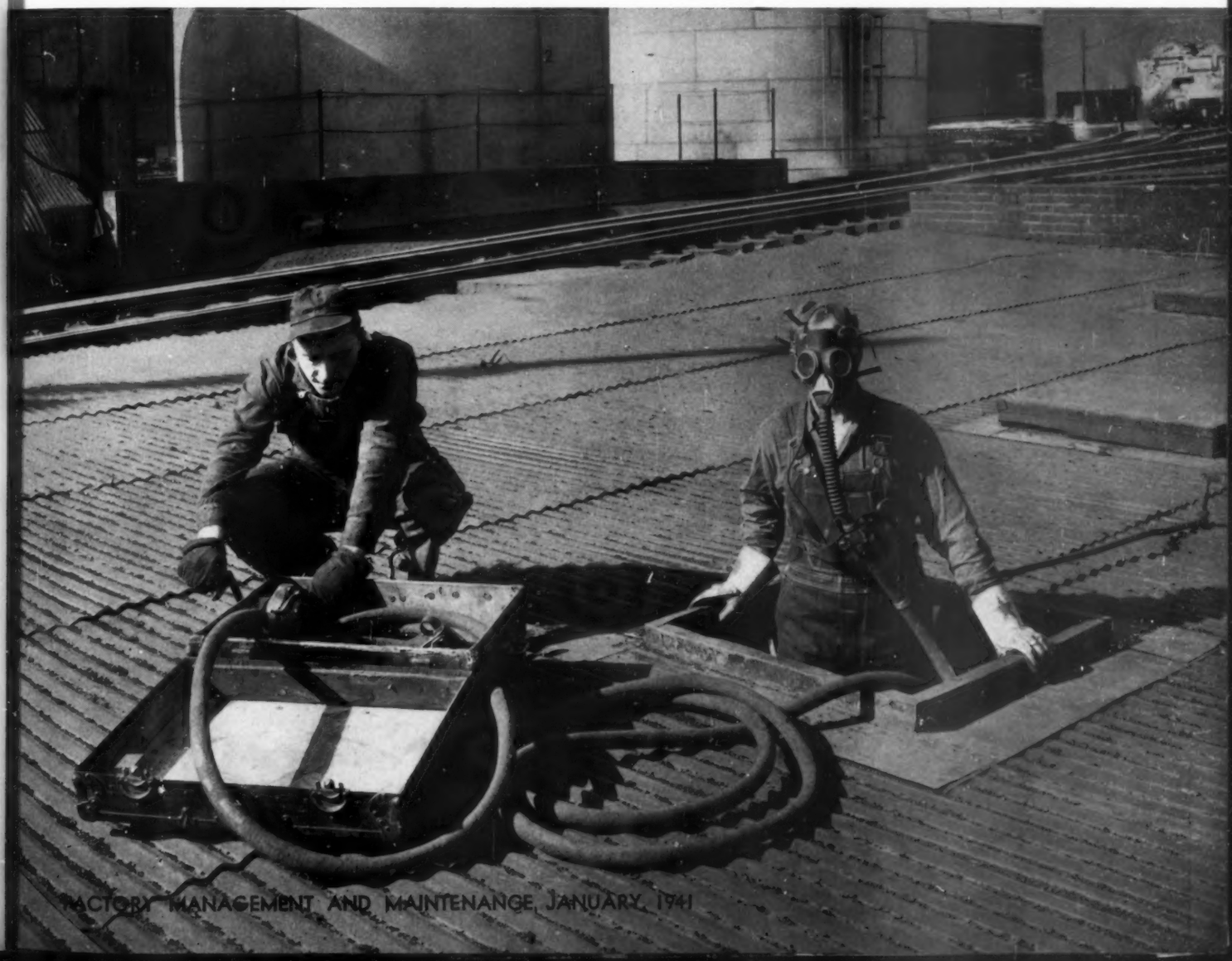
This report is made in language the layman can understand, contains no statistics, but is made up of newsy items like "One of the night shippers has had a stomach condition for three years. We have finally convinced him that he should take the time and spend the money to seek a complete diagnosis. Have referred him to a clinic."

What does all this cost? See the table for itemized expenses. Equipment? Doctor Everts says from $200 to $400. Which reminds us: What happened to the fellow who wanted to know "what the small plant could do about it"?

More Work Because They're Safe

AMERICAN INDUSTRY FACES TWO BIG JOBS. It must turn out—in increasing numbers—the guns and tanks and planes needed for Britain's defense and ours. It must continue to produce—in increasing amounts—the peacetime goods that the American people must have for uninterrupted good living. In every plant up and down the land, the emphasis is therefore going to be on increased output. And increased output is possible only when men work in safety. Thus safety, always important, always good business, becomes increasingly important, increasingly good business as industry moves forward to new production highs. But there is no royal road to making the plant a safe one to work in. That safety is an everlasting job, where painstaking attention to details is of the essence, is demonstrated in this picture story of safety techniques that work at Timken Roller Bearing Company, Canton, Ohio. Whether it's a dozen punchpress operators, half a hundred in a heat-treating department, or two maintenance men doing a job in a tank (below), *it's safety from the start at Timken.* (CONTINUED ON NEXT PAGE)

On production lines, on maintenance jobs, Timken people know they're safe. For instance, Zello Rouse in the hose mask goes down the hatch to clean a tank. No danger of being overcome by fumes with Charles Leonard manning the fresh air pump. In actual practice, Leonard pumps farther away from opening, to be sure the air he pumps is pure



Blackboard inside main gate helps keep safety story from getting cold. Departmental scores are chalked up daily

It's Safety From the Start a

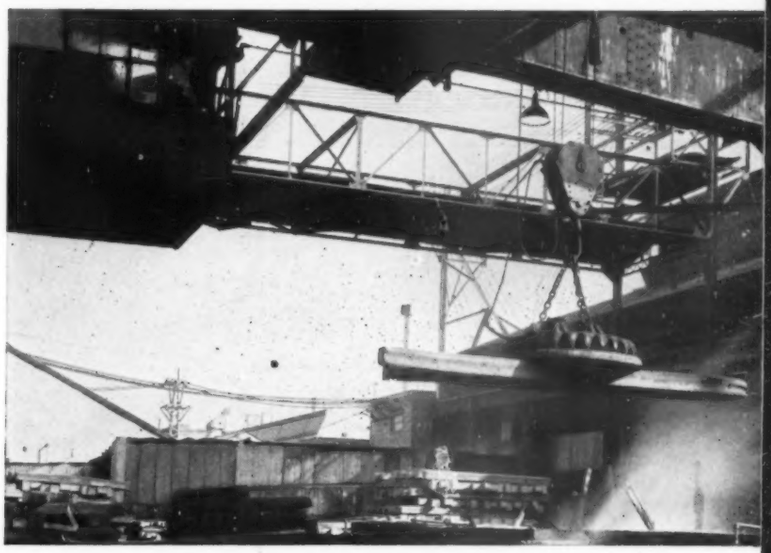
FOR EVERY ONE of Timken's 11,000 employees, safety began the day he was hired (right). It continues every day of his work life. It truly never ends. Timken record (above) is a good one. But no better than any other plant's can be, provided only it goes after safety in the same wholehearted way. Nice part of it all is, any one of the safety techniques illustrated on these pages can be lifted "as is" and put to work tomorrow in any plant in the manufacturing industries—at small cost and with many happy returns of the investment.

Every new employee gets a copy of safety instruction booklet when hired, must familiarize himself with the rules. "New" man in this case is James Reed of compensation department, eleven years with the company. The booklet hander-outer is Robert Parks

Nicked finger brings John Yates a-runnin' to Nurse Rose Chopard. Yates is in self-contained bearing assembly which operated last year without accident

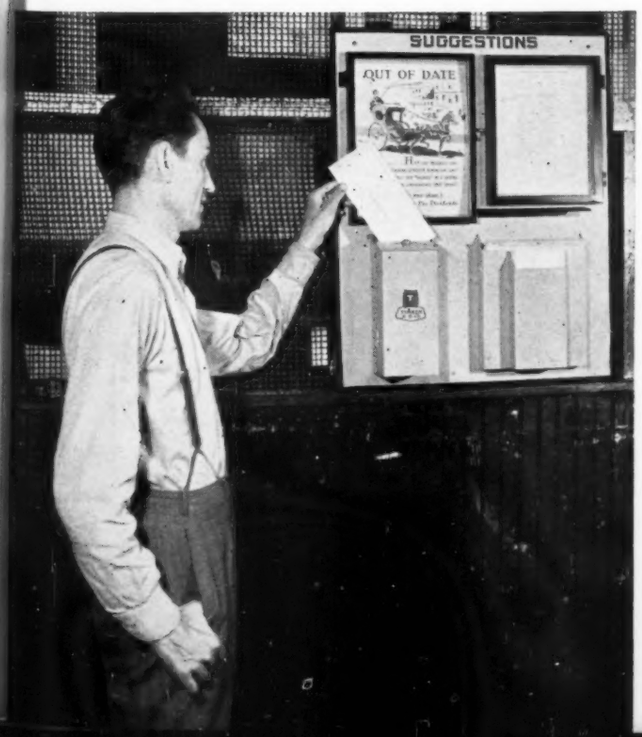
Stretchers are kept handy, just in case. Conspicuously posted notices warn employees to report injuries. Lewis Scott, checking out hasn't had an accident in 17 years

Special rules for cranemen make bloom pickle yard a safe place to work in. Safe operator, is Kenneth (Red) Brown, who wins prizes for playing the banjo

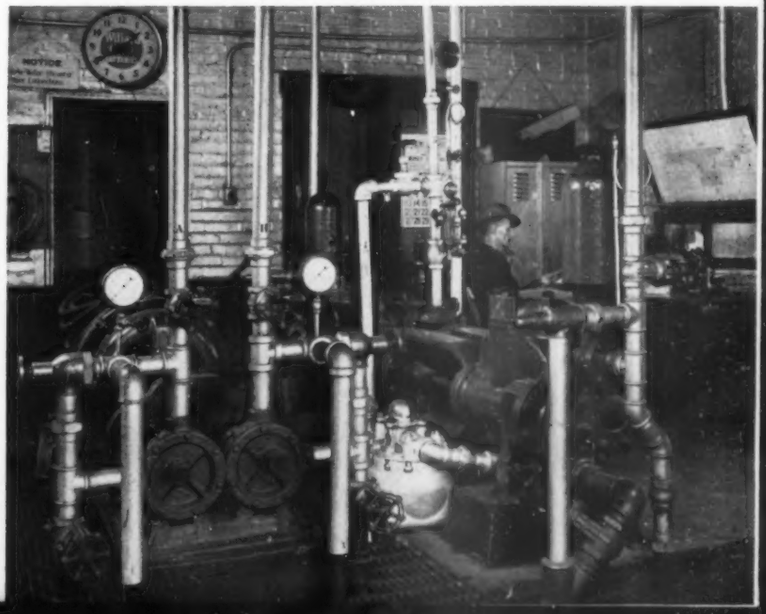


John Agen of tool crib drops suggestion in box. On board is list of ten people who got awards during past month. Many of the suggestions concern safety

...t at Timken



Installed 14 years ago, these pumps have never been used except in weekly check-ups. They're there to blanket eight oil tanks in case of fire. Fire inspector is Harry Crooks



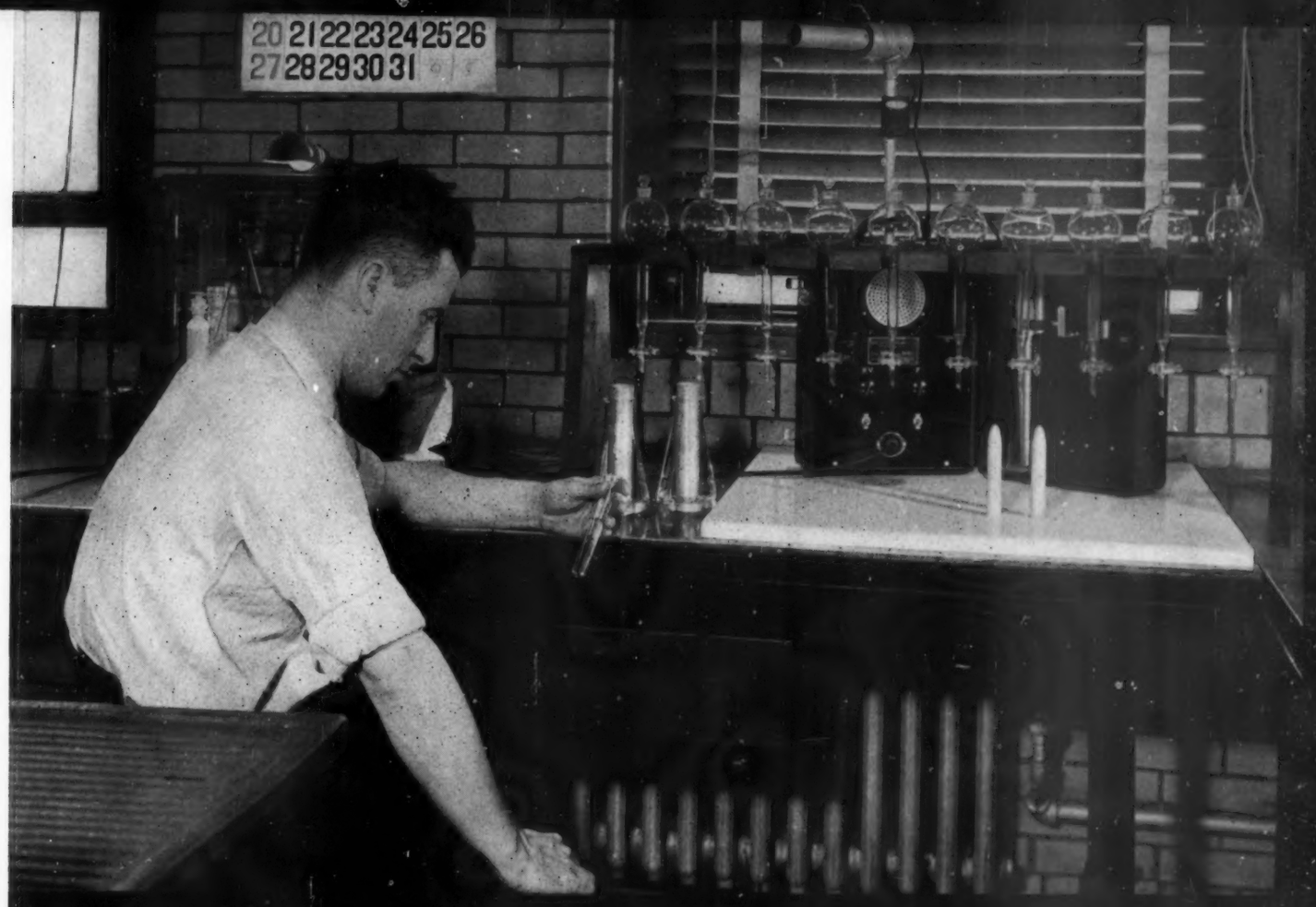
DRESSED RIGHT FOR THE JOB

SAFETY CLOTHING is a Timken *must* on specified jobs of hazardous nature; the company supplies it free to men like rigger at right and chromium platers below. The wearing of safety shoes is encouraged; they are sold at cost. Timken employees purchase something like 2,500 pairs each year.

Tobie Saker treats himself to new safety oxfords. Jack Crowl on the fitting stool

What the safe-dressed rigger should wear, is here demonstrated by Carl Laughman who sports one-piece molded skullguard, gloves, and safety belt

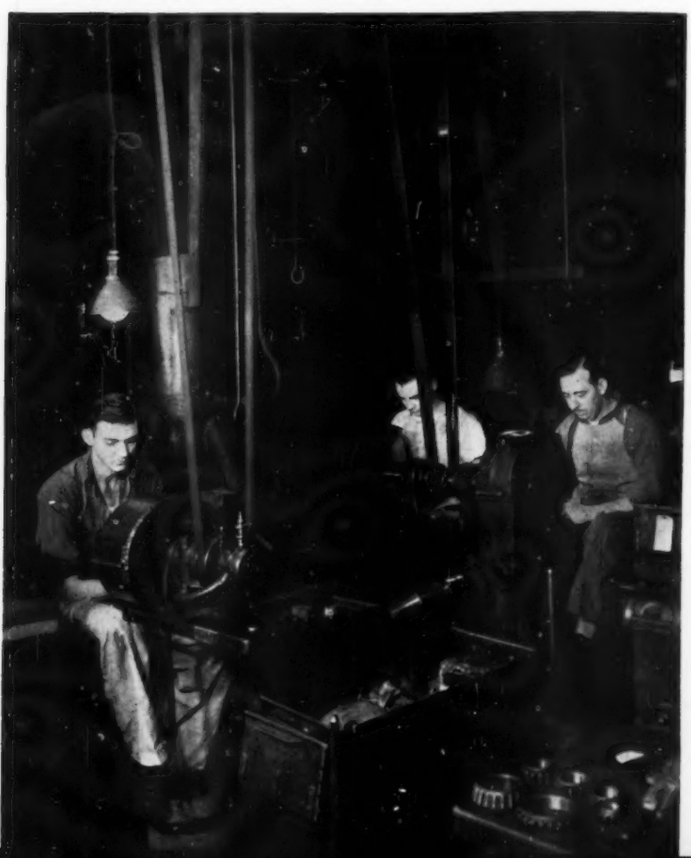
Company supplies Ray Tallman (left) and Charles Robbins of chrome plating department with complete protective outfit consisting of safety shoes, rubber gloves, heavy apron, and fireproof clothing. Positive ventilation removes acid fumes



SAFE FROM DUST AND FUMES

Elimination of hazardous dusts and fumes is an important phase of Timken's safety program. Samples of air are taken in the portable electrostatic dust and fume sampler which stands at the rear of the table, are later analyzed in lab

Timken knows that good ventilation means more work and better work. Each of the dozen or more machines on this polishing line is hooked up to the exhaust duct at rear



J. W. Gourley, safety engineer, goes gunning for carbon monoxide, uses a small, easy-to-carry detector. It takes only ten squeezes and ten seconds for him to make a test

Officer Fred Von Gunten nabs Calvin Hartzell on two serious counts. Not only has he pushed up the glass guard on the grinding wheel. He's also wearing his goggles on his cap, which is the wrong place to wear goggles. The 95 members of the Timken police force act as safety inspectors, help keep men up to the mark

Their Eyes Are Safe—So Are

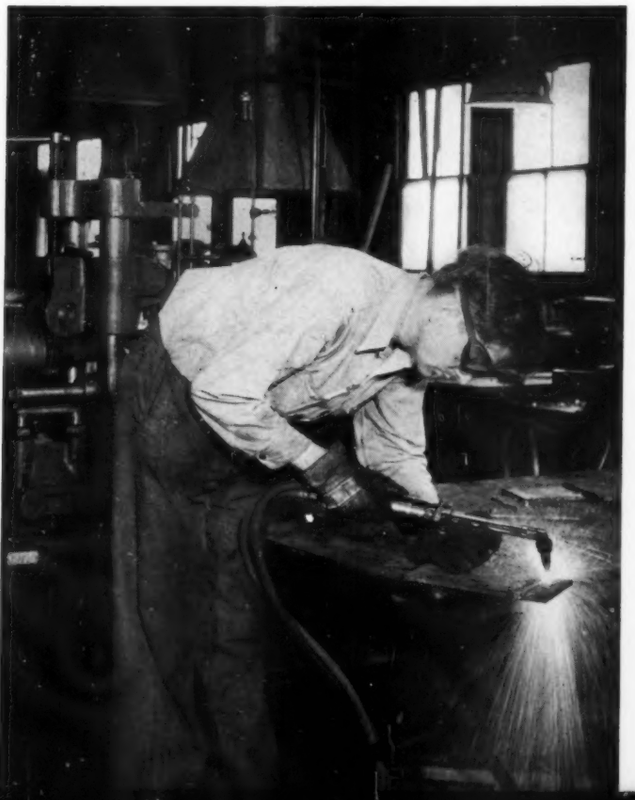
To be safe, factory workers must be in first-class physical condition. Timken employees get complete check-up every year. It includes eye test on instrument that measures depth perception, visual efficiency, muscle balance, and reading distance fusion. Dr. A. W. McConkey examines; David Gervason gets examined

Only way to tell when a part is properly carburized, is to break it. Only way to break it safely is in goggles. Breaker is Bob Thomas — no accident in his 4 years' service

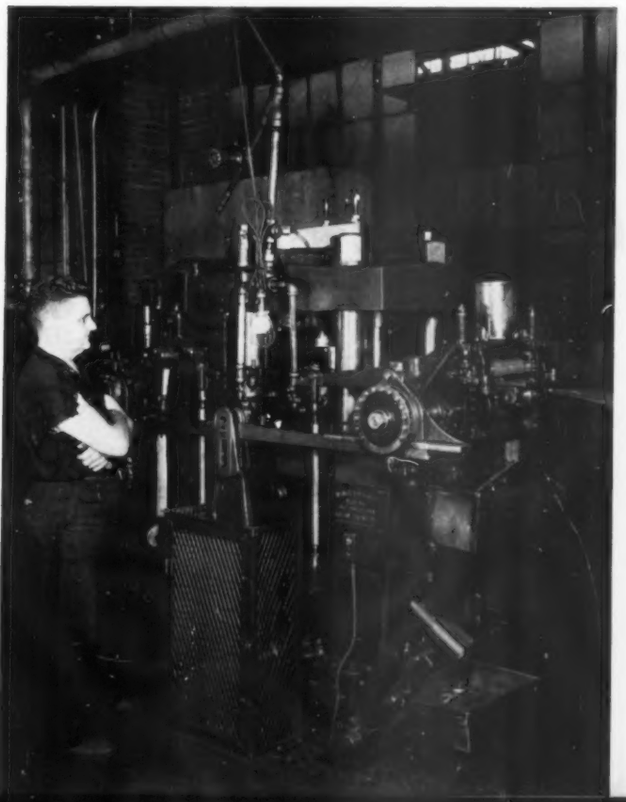
Anthony De Stephen, welding pins on big railroad driver bearing, wears a mask. Melvin Lutz, foreman, uses a hand shield to inspect job. Portable exhauster removes fumes

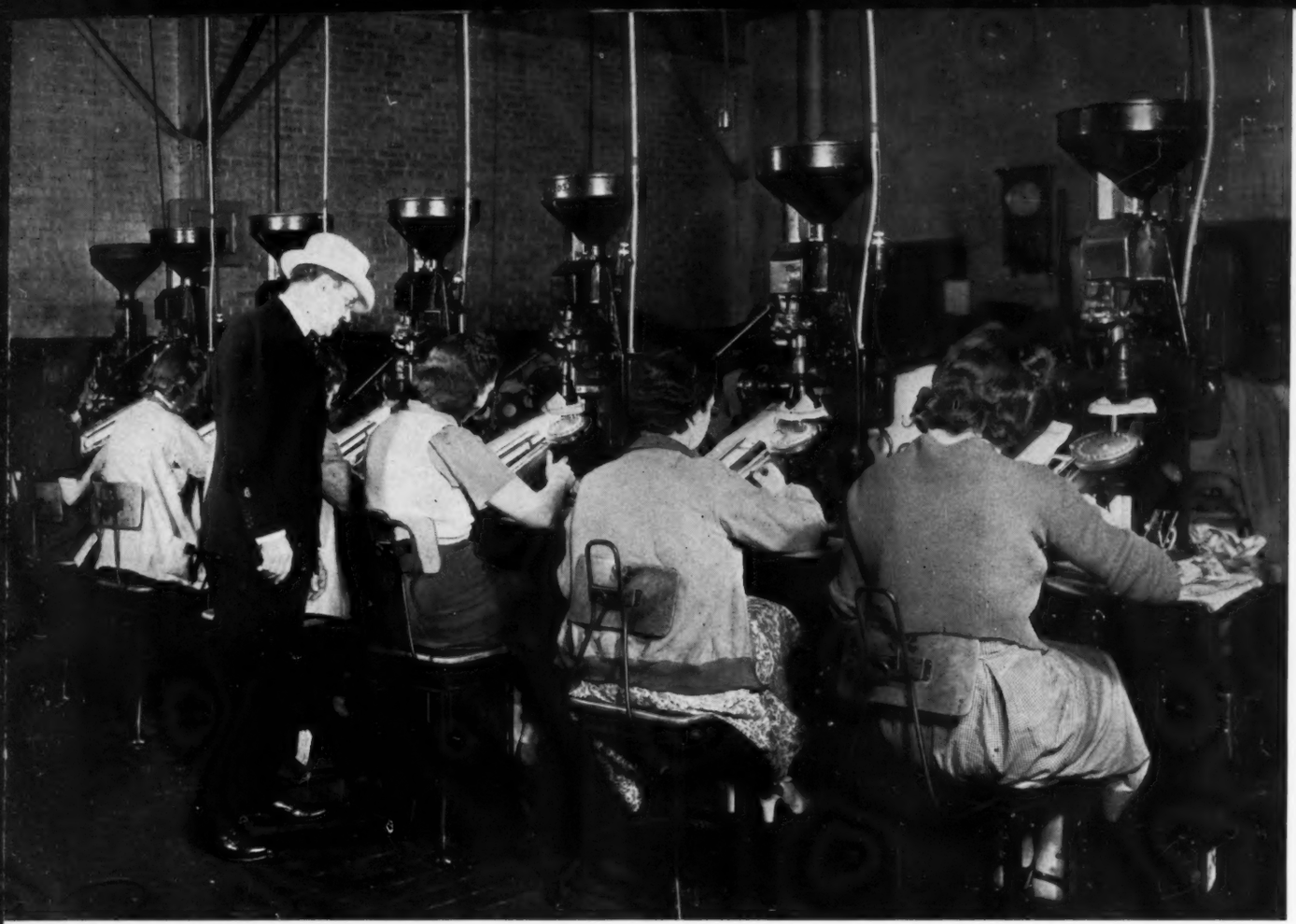
Their Fingers and Hands

Goggles provide cheap and sure eye insurance. Timken sees to it that men wear only tested and approved types. Bob Brown of sheet-metal shop wears them as matter of course



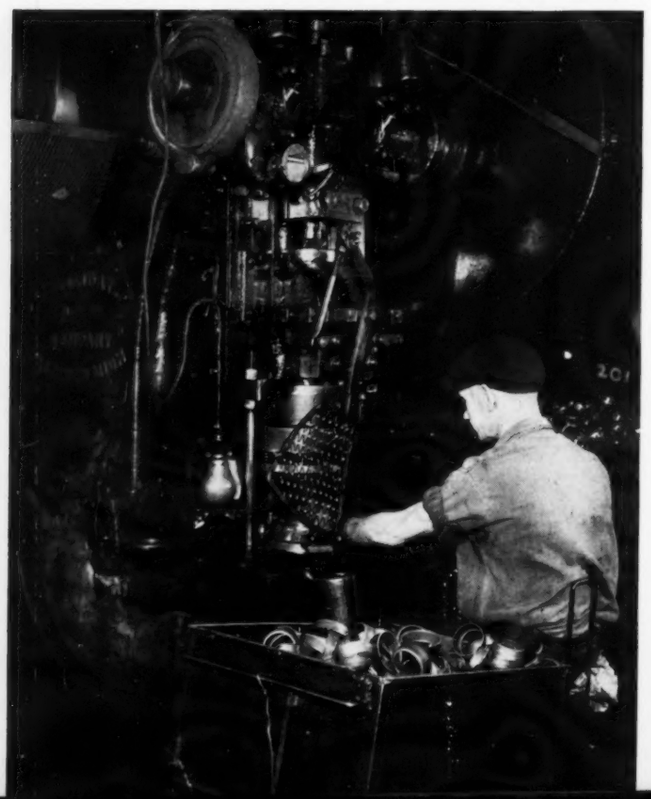
Wherever feasible, Timken uses automatic feeds. Russell Conley stands with folded arms while 150-ton press blanks out 152 cages a minute. No danger of his losing a finger



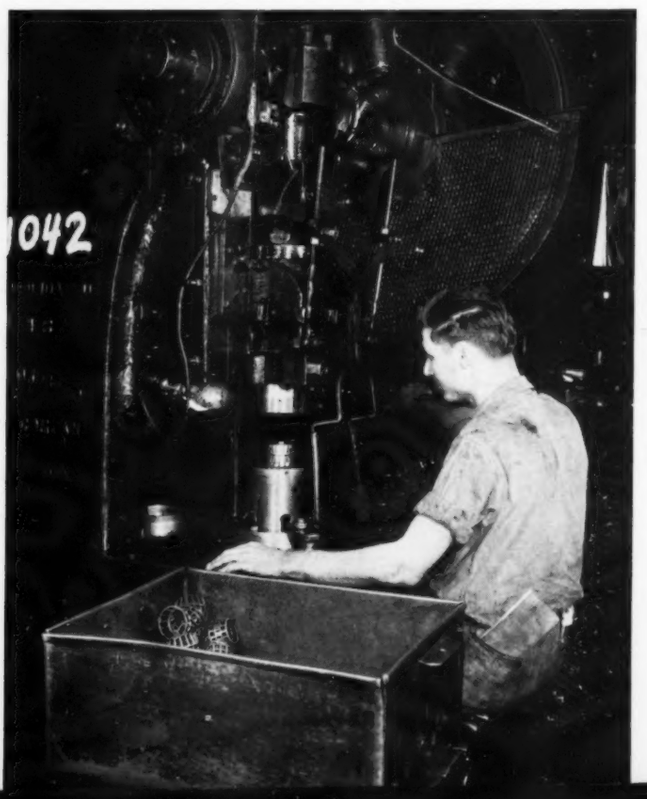


Timken's medical director, Dr. Edward M. Feiman, counts that day lost when he does not make an inspection trip into the plant. Always insistent on good lighting, he stops here to look over a recent fluorescent installation which enables girls to inspect ten rolls at a time under magnifying lenses. Rolls are fed and turned automatically

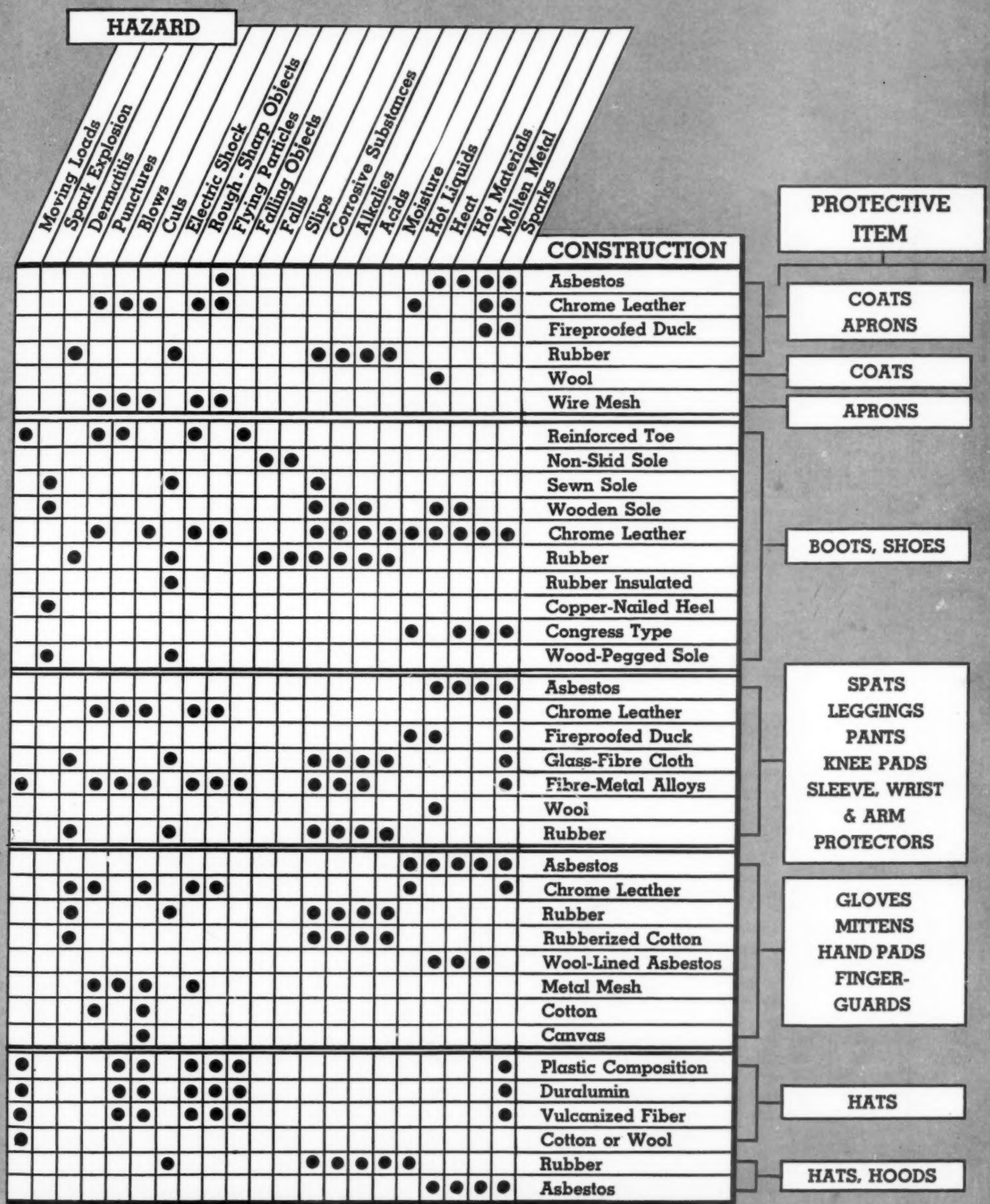
Tom Nevius feeds part into die with left hand, hooks it out with right. Cage on swing guard prevents him from sticking left hand in back of guard and losing a finger



Double-acting swing guard takes both of Dan Luckring's hands out of danger. Dan works alternately with right and left hand, wouldn't dare put on speed without guard



What Safety Clothing Where



Published through the courtesy of American Mutual Liability Insurance Company

A Dozen Safety Tips

How Safe Is My Department?

That was the name of AO's 1940 safety contest. To be fair to all departments, standings were determined by safety records made during the contest, compared with department records during the three preceding years.

For example, if a department had a rating of 20 points for the three years and rated 10 points in 1940, its score was 50 percent. Similarly, a department with a 3-year average of 10 accident points had a contest standing of 100 percent if it duplicated its average record. A perfect score, in points or percentage, was zero.

According to the rules, all accidents were graded according to seriousness. For instance a sprain or strain that required no outside medical attention was counted as 25 points against the department in which the man worked. If the sprain required the attention of a specialist, or an operation, it cost the department 150 points. Accidents were graded by the nurses as they came into the medical department. Results were announced on charts posted in each department, also in the plant paper.

Based on records up to November 1, there were fewer accidents than the average for the three preceding years—this despite the fact that personnel was increased substantially during 1940. "More workers and fewer accidents" is about the best slogan for any safety campaign.—*Source:* American Optical Company, Southbridge, Mass.

We Let the Workers Write the Safety Rules

Whatever a company's personnel policies may be, they work only if foremen and employees make them work.

We overlooked this axiom when we first drew up our safety rules. To be sure, they were carefully thought out, couched in well-rounded phrases, printed in an attractive booklet. They were accepted by foremen and employees. Yet they didn't really take hold.

So we got off to a new start in 1940 when committees of foremen and workers in each production division took over the job of rewriting the rules.

One of the first things they did was to switch from printed booklets to mimeographed sheets which could be easily revised. They wrote the rules in words that *could not be misunderstood*. Perhaps the King's English was butchered here and there. If it was, so much the worse for the King's English. Anyway, safety rules were given a real meaning, and the men who had a sense of authorship were highly interested in seeing that they were observed by one and all.

The work of these committees has since been extended to investigation of accidents and to plant inspections. Responsibility for accidents has thus come home to roost. Safety is no longer something the personnel department dragged in.—*J. A. Garvey*, Director of Manufacturing, Dennison Manufacturing Company, Framingham, Mass.

Getting Under the Hides of Maintenance Men

Safe thinking on the part of maintenance men is more important than a thick volume of safety rules. For example, we keep pounding away at the electricians with a single sentence like "That damn stuff will kill you!" It finally gets under their hides, makes them study and observe the rules.

Weekly safety meetings help. We get out a letter to foremen once a month with suggested topics. The foremen also ask the boys for suggestions, then discuss condition of equipment, tools, and rigging. As a follow-up, foremen must send to my office a monthly letter mentioning items that were discussed. Thus we train for alertness and safety consciousness, and provide for continuity and follow-up.—*Frank Elwell*, Works Engineer, Buick Motor Division, General Motors Corporation, Flint.

Took a Plant Safety Census

We took a tip from the national census. Questionnaires were printed on cardboard the same size as time cards, and a copy was placed in front of each card. Boxes were provided for completed questionnaires. The project was entirely voluntary. Employees did not even have to sign their names. We felt an employee would be apt to answer truthfully if he knew that the idea was to get general information and not to pin him down individually.

First result was that it made the employee think about safety for a few minutes while he filled out his card. Some 1,300 cards were distributed; we got a 45 percent return. Although we had known for some time the number of safety shoes being sold, this was our first definite information as to the number of men in each department who were actually wearing them on the job. —*Henry G. Lamb*, Safety Engineer, Scott Paper Company, Chester, Pa.

SCOTT SAFETY CENSUS

Please fill out this card and give to your Supervisor or place it in a Company Mail Basket.

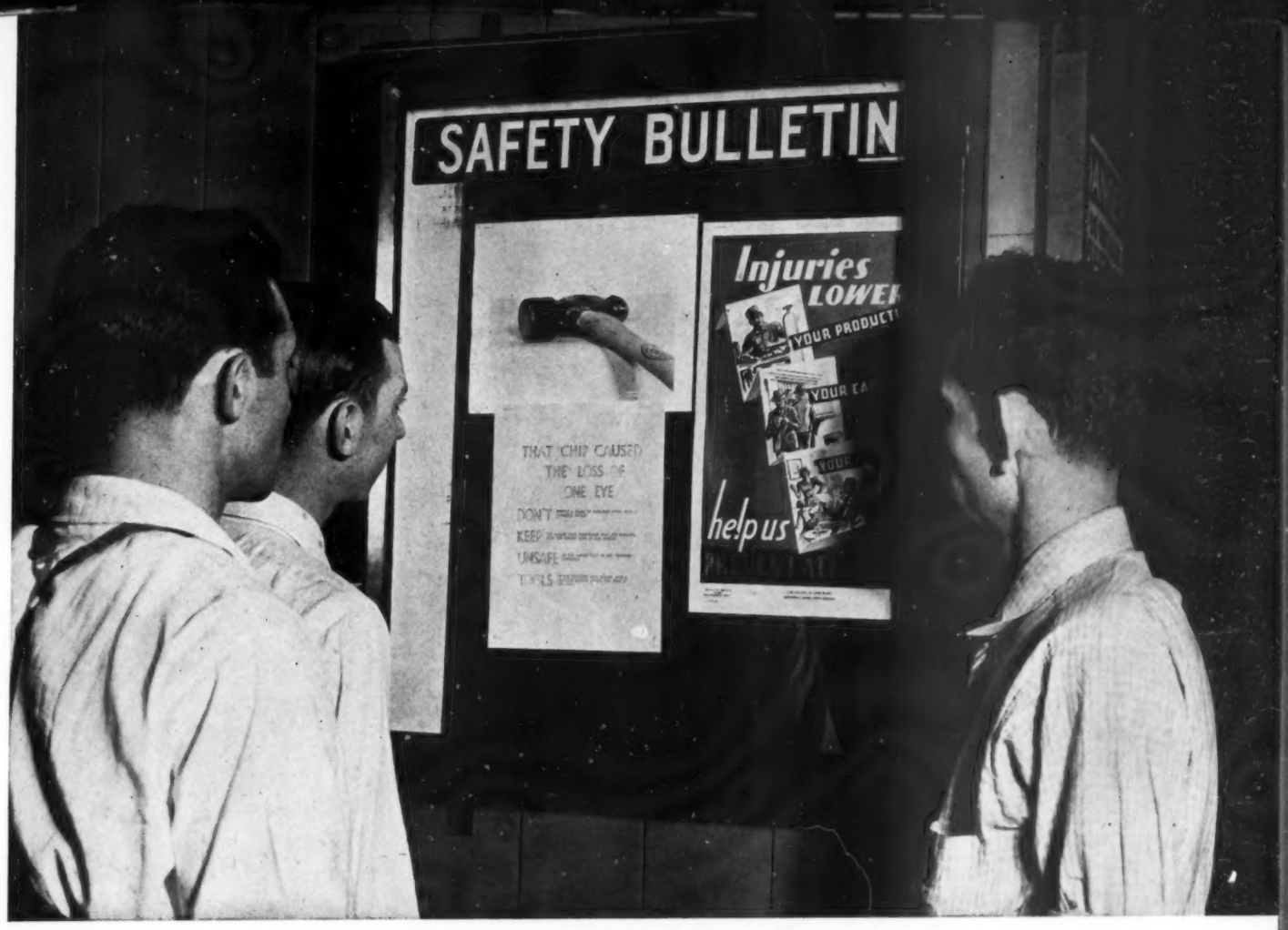
1. Would you be interested in taking a course of instruction in First Aid?..... Yes____ No____
2. Men: Do you wear Safety Shoes?..... Yes____ No____
3. Girls: Do you wear Low or Cuban Heel Shoes at work?..... Yes____ No____
4. Do you know the location of the nearest First Aid Stretcher?..... Yes____ No____
5. Do you know how to use a Fire Extinguisher?..... Yes____ No____
6. Have you been thoroughly instructed what to do when the Fire Alarm Rings? Yes____ No____

If yes, please tell what you do: .....

.....

What Department are you in? .....

In Scott Paper census, so many employees wrote "yes" in answer to the first question that Red Cross first-aid classes were started last fall



At the Glenn L. Martin Company, Baltimore, where large numbers of semi-skilled workers are being absorbed, much stress is laid on selection and care of tools. Photographic displays like this one serve to drive the lesson home

How Time-Study Men Can Help

Unless you have enlisted your time-study department in the cause of safety, you are overlooking a bet.

When a new job is being laid out for time study, that is the best time of all to analyze each cycle for accident hazards. A good time-study man is trained to follow each move of the operator, question efficiency of equipment, observe arrangement of material. It is perfectly obvious, then, that he is in an equally favorable position to detect accident exposure.

The real benefits come from getting the job started in a safe manner because it is then that the work habit or routine is established. If the wrong habits are formed, they are most apt to be followed until an accident forcibly calls attention to the error. Utilizing time-study and planning departments to detect errors before the accident, is much better than learning the hard way by accident experience.

For such a program to "click," you must have the whole-hearted support of the man in charge of planning and time study as well as the foreman. The job of training time-study observers to recognize accident possibilities and with the help of the foreman to "do something about it," is where the safety engineer ties in and is the essence of effective cooperation.

When you get to a point where the time-study man refuses to time an unsafe set-up, then you can bet both foreman and employee will be impressed that when you say "safety first" you mean just that.—*Van B. Hunter*, Supervisor of Safety, International Harvester Company, Chicago.

A Club All Want to Join

Under our Safety Club plan, meritorious no-injury performances are recognized. The Club is divided into five groups—1,000-, 2,000-, 3,000-, 4,000-, and 5,000-Day Clubs. Employees who complete 1,000 days without a minor injury are presented with a button; those completing 2,000 days get a "2,000-Day Club" button, and so on.

With each button goes a certificate. Should an employee have an injury, he must relinquish his button, but he keeps his certificate. One department of 525 people has 97 in the 2,000-Day Club, 125 in the 3,000-, 13 in each of the 4,000- and 5,000-Day Clubs.—*J. T. Brown*, Safety Supervisor, E. I. duPont de Nemours & Co., Old Hickory, Tenn.

Minute Men for Emergency

Faced with the task of immediate defense production with attendant increase of working hazards, Westinghouse's Nuttall Works has formed an emergency squad of 45 "minute men" who swing into action at a moment's notice.

Men meet monthly for first-aid and fire-control drills, learn how various chemical fire extinguishers are designed, how they operate, and the purpose for which each is best suited. They are taught sprinkler system arrangement, source and control of water supply, location and operation of intermediate control valves.

They are instructed what to do and *what not to do* with seriously injured persons. They also learn how to apply artificial respiration and arterial pressure to control excessive bleeding.

Expert instruction shows men how to lead fellow-employees to exits and help to avoid panic; how to follow through after crisis, restore protection

facilities to normal, and check for new hazards resulting from the occurrence. —*C. J. Gerhardt*, Gearing Division Safety Supervisor, Westinghouse Electric & Manufacturing Company.

Hits the Supervisor in the Pocketbook

Last January 1 management of the largest division of our company sponsored a plan that carries the supervisor's safety consciousness right down to his pocketbook. For years the division had given awards and bonuses to supervisors for quota-breaking performances in quality, efficiency, waste, etc.

The new wrinkle was to deduct a certain number of points per week from each department's score for every disabling accident.

This brought supervisory interest to a new high. In 1938 accident frequency was 13.4. In 1939 it dropped to 10.4. For the first nine months of 1940 it was 6.2.—*M. M. Olander*, Personnel Director, Owens-Illinois Glass Company, Toledo.

Creating Friendly Rivalry

During 1940 the record of the operating departments for continuous working days without lost-time accidents was prominently displayed, together with the current month's record on safety and housekeeping. Each month the three departments having the best record were given a display on the bulletin boards of the safety engineer. Pictures of the three departments, together with their percentage ratings, were shown. These signs have created a genuine friendly rivalry, have been instrumental in improving housekeeping, and have resulted in cooperative effort to avoid lost-time accidents.

Out of 32 departments, 24 had turned in a no-lost-time-accident record up to November 1. Several had completed three years without a lost-time accident and were making every effort to maintain their record.

The chart of percentage rating used by the Central Safety Committee has been satisfactory in avoiding dissatisfaction over ratings. The five members make their inspection and determine their rating individually.—*J. C. Henny*, Chairman, Central Safety Committee. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

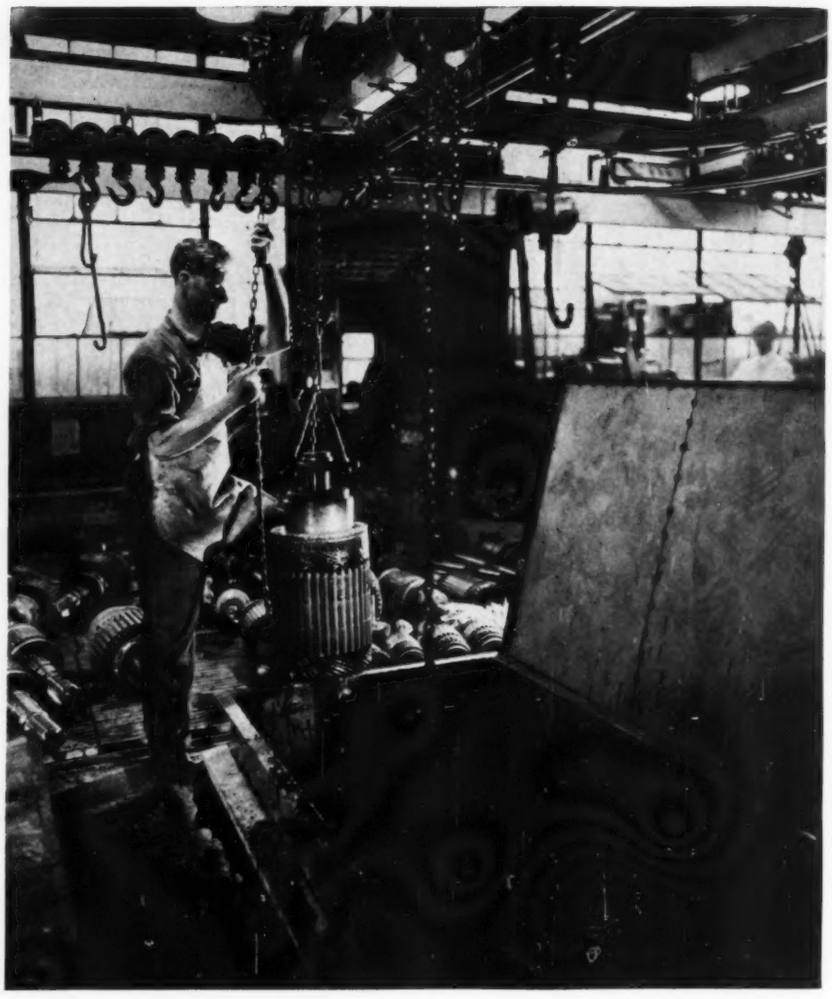
Safety for Green Hands

Recent increases in personnel called first for enlargement of the safety department's staff. But over and above this phase of the problem was the bigger job of breaking in a large number of inexperienced hands.

Rather than meet the emergency with new appointments from the outside, men of foremen's rating were selected to augment the safety staff. They continued under the authority of the operating departments, but were given all possible aid and instruction in their new capacity of safety inspectors.

They were given the same authority as the regular safety staff. But their major job has been to instruct and follow up the green man. They point out the hazards and coach him in the safety rules of the department.

Net result of this approach has been a curtailment of accidents. Frequency rate for the first 8 months of 1940 was 2.73 compared with 5.35 for same period in 1939, and compares with an average of 4.18 over the past 5 years.—*Source:* Bethlehem Steel Company.



Dip tanks at Reliance Electric & Engineering Company, Cleveland, are protected by piping a fire-smothering fluid to four spray nozzles just above the surface of the varnish. Each tank is served by two 5-gal. extinguishers mounted upon a tilting platform. A temperature-pressure bulb "sounds the alarm" by tripping the tilting control of the platform

Spot Accidents Before They Strike

In a questionnaire designed to spot accidents before they strike, employees were asked 25 thoughtful questions: Is your equipment properly guarded? What is your suggestion for making it safer? Do you know where the nearest fire extinguisher is located? Do safety posters interest you? Faced with an emergency, could you give artificial respiration correctly? What do you think can be done to impress men with the need to work more safely?

As a result, safety advisors got new ideas, found out what topics needed more discussion in safety meetings, learned *which* departments needed *what kind* of instruction. Best of all, they improved an already commendable safety record.—*Source:* American Rolling Mill Company, Middletown, Ohio.

In by Noon, Out the Same Day

That's order-handling routine at Brach's. Conveyors and a loudspeaker dispatch system, unhampered by paperwork, speed the flow from stockpile to car and truck

ARTHUR VAN VLISSINGEN
Consulting Engineer

NO MOVE IS MADE to fill most orders received at this factory until the railroad car is spotted at the shipping dock or the highway truck is backed up to its place at the platform. Three minutes later the cartons begin flowing into the car or truck by conveyor, continue in a steady stream until all goods to be shipped by this route have been loaded. Orders are filled from stockpiles that are kept filled from the outer aisles by mechanical handling equipment; cases are laid on fast-moving conveyors by order clerks who get their instructions by loudspeaker system—they do not see a customer's order, merely hear their instructions and act at once.

This unusual method is in use in the candy plant of E. J. Brach & Sons, Chicago. It keeps finished product moving in an almost uninterrupted stream from the packing machines to the customers, fills hundreds of orders totaling many tons of product on an average day. A minimum of elapsed time comes between receipt of the order and actual shipment. One reason for the high speed of the entire operation is the almost total elimination of paperwork and clerical operations between the incoming mail room and the outbound shipping door.

By Pneumatic Tube

When an order is received in the office, it goes through the credit and order-pricing departments, moving on a belt conveyer between operations. When it is priced it goes to the shipping department by pneumatic tube; the number of pieces required for the shipment is marked on the order. Then the order is pushed through a window to the stencil department where a stencil is cut giving only the customer's name and address and the routing. The finished stencil is sorted into a rack of pigeonholes, one compartment for each railroad or truck line. Here it remains, with order attached, until the railroad car is spotted or the truck backed into place at its window.

There is just one exception to this routine. If an order calls for any assortment of merchandise in 5-lb. boxes, instead of the usual full cartons of each kind, it is sent on receipt to a special packing department. The 5-lb. items—this plant's equivalent of a broken-lot shipment—are all chocolate, and are handled direct to this department in the 60-deg. cold stockroom from the manufacturing department. The 5-lb. orders

Order pickers at Brach's never see a customer's order. They get their instructions by loudspeaker from order callers at control desk. Order callers take turns at the microphone; each is in charge of one of two main conveyors that run through the stockroom

are here packed by hand into cartons, the cartons are marked with the order number. Then they are stacked alongside the branch conveyor in the 5-lb. department and held until the rest of the order is shipped. Once these assorted cartons are ready, the order goes back by tube to the stencil room where it waits along with the other orders in the pigeonhole rack.

Near the truck dock is stationed an operator referred to as the switch-button man, because one of his major duties is to push the proper switch button to divert goods on the main conveyor to the branch serving the particular truck that will haul them away. The switch-button man has one end of a two-station loudspeaker system. As soon as a truck backs up to the dock at a given window, he announces it over this equipment: "Smith Cartage at Window 4." At the other end his message is heard by the man in charge of the stencil room. He pulls all Smith truck line stencils and orders from their pigeonhole, sends

Original order goes by overhead basket carrier from order callers to checkers. Latter work as a team; one calls, other checks

them instantly by basket to the central control desk of the entire system.

The central control desk is raised above the two main conveyor lines which run side by side through the stockroom. Until a year ago, there was only one conveyor here, and only one man sat at the desk. Now two men sit at the desk, one for each conveyor. One conveyor serves truck windows 1, 2, and 3; the other, 4, 5, and 6. Either can serve the railroad platform, but this is less often in use because l.c.l. rail shipments are normally trucked to the freight stations to save time over using a trap car.

The men at the control desk are known as callers, and the desk itself is called the pulpit. Each is in charge of one of the main conveyors, but they have only one microphone between them and take turns calling orders. Their post is about the middle of the stockroom, and loudspeakers from their microphone are situated all through the 60-deg. stockrooms (including the 5-lb. packing section) and through the ordinary or 70-deg. stockroom where all except chocolate items are kept.

Goods come down to these stockrooms from the upstairs production departments by chute and conveyor, and are then spotted at their proper storage points by lift truck. Through the cold room passes a single belt conveyor 140 feet long, running 300 feet per minute. It passes through a wall opening into the main room, and from this point there are two belt conveyors, each 280 feet long and running 270 feet per minute.

Stockpiles run back at right angles to the belts, and an order picker is in charge of a number of piles. He takes his instructions only from the loudspeaker. Remember that the orders and stencils for a truckload have been sent to the pulpit control desk, and the truck is backed up at the door. The window at which the truck is parked determines which conveyor the order will travel on, hence which caller will have charge of the job.

Red Lamps Tell All

The caller speaks into his microphone, giving the names and quantities of the candies required. He first calls off any 5-lb. items, since these must travel on a branch conveyor to reach the main conveyor leading out of the chocolate room. Next he calls off any other chocolate items, since these must start on the single conveyor in that room and travel to the double conveyor. As he calls the chocolate items, he touches a switch button, and a gate switch at the end of the single-line chocolate conveyor swings to make sure that these items are transferred to the proper conveyor line of the two going through the main room. When the gate swings, it trips a switch that turns on red telltale lamps every few feet along the side of the particular conveyor that is now being loaded.

The cartons that have been waiting for this order number in the 5-lb. department are started on their way. In the chocolate stockroom, the order pickers put on the conveyor the items required from their piles. The goods needed from the main room are now called, and the order pickers put these on the conveyor that is signal-lighted. It all happens within a few seconds. The first case in line in an order gets a crayon mark so that the order will be kept separate from the order ahead of it. When the first case of the order comes even with the pulpit, the order picker at this point lays the proper stencil upon it.

As soon as one caller completes calling an order, he takes care of the odds and ends of detail in preparing the order to go to the checker and the stencil to move along with the goods. The other caller immediately starts in to call his next order. Thus they alternate, all day long.

The order, complete with its stencil, moves past the pulpit to a stenciler, who stencils each package as it moves along. Beyond him it goes to another desk, where two men work as a crew on each line to verify the accuracy of the shipment. To one of these men the order sheet comes on an overhead basket-type carrier from the pulpit; the carrier snubs at the end of the trip and dumps the paper down a chute to the desk surface. The first man of the team calls off the customer's name, destination, and route, and then calls off the individual items by stock numbers and quantities.

Mind you, this is still the original order sheet that passed through the stencil room. The second man, the checker, actually compares these called-off facts with the stenciled address, the stock numbers on the cartons, and so on. If anything is wrong, the checkers stop the conveyor, speak into the loudspeaker system to tell what they need, and it is hustled along on the other side of the conveyor before normal activity can be resumed. Errors are rare.

Carries the Flag

The first order for a given window carries a pinned-on flag with the number of that window, for the guidance of the switch-button man who operates at the end of the system. When he sees a flag coming, say No. 4, he throws the switch electrically so that all boxes on that line shunt off to Window No. 4.

In practice, the orders for the trucks backed up to the six loading windows can be put on the conveyors so rapidly that any one truck driver and his helper would be swamped, and their conveyor would soon clog up to block traffic. Therefore, when a conveyor begins to pile up too far back from the truck window, or when another truck's conveyor empties, the switch-button man notifies the pulpit over his loudspeaker station, and the callers shift over to orders for another of the parked trucks. Thus the system is kept in balance, and it is possible for several trucks to load simultaneously.

Each of the window conveyors runs up to the aperture, and an 8-ft. extension can be pulled out from under the fixed portion and through the window right into the truck body. If the unit loading is a big trailer, the switch-button man hands through the window a 10-ft. portable lightweight conveyor section which can be hooked to the end of the extension, and a lightweight horse to support its far end. Thus the cartons are mechanically handled all the way to the truck interior, leaving the truckmen merely the task of setting each carton where they want it.

Each of the two conveyors serves three truck windows. Flag on first order for a given window signals the switch-button man to do his stuff and divert orders to right truck

Also a chute from the upstairs production department leads down from above this room adjacent to the truck platform, and discharges its load of finished goods upon a conveyor leading to the 60-deg. storage room. If, however, the need is to send these goods to an outside warehouse for cold storage—as before the Christmas rush season—a hand-operated switch directs them to the conveyor branch serving Window No. 6. All trucks to outside cold storage, or less frequently to haul away orders large enough to require shipment direct from the production department, are backed up to this one special window.

Now to return to the actual order sheet, which we left as it was being checked at the checking desk on the stockroom conveyor. Once checked as complete and correct, the order sheet is accumulated here with others similarly checked. When the basket fills up, the order checker puts them into a pneumatic carrier tube and sends them back to the shipping department office. Here they are run up for gross weight, and bills of lading are written and issued. Then the orders go upstairs to the office by pneumatic tube, duly stamped "Shipped," for the final paperwork and billing to be performed.

It is unusual, except in the peak rush of late fall, for an order received in the mail room before noon to fail of actual physical shipment on the selfsame day. The effort required is greatly reduced by the simplified method based on the assorted types of mechanical handling equipment and the loudspeaker installations, which keep things moving without delays and without surplus office operations. The method was devised when the business was small, has been expanded and developed mechanically to keep pace with the company's growth. No definite measurements of savings are, therefore, possible. But the management is sure that these are substantial in comparison with the costs that would be involved in any other type of handling which could give customers comparably rapid and accurate service.

Goods are chuted from production departments and spotted by lift truck on stockpiles running at right angles to cold-room conveyor, which splits up here into two branches

Laid Out a Motion-Study Lab

For anyone who's thinking of setting up a motion-study laboratory in his plant, here are full details, all the way from floor plan to a list of equipment and its cost

ASA S. KNOWLES and WILLIAM T. ALEXANDER

Dean, College of Business Administration and Assistant Professor of Industrial Engineering, Northeastern University

NOT SO LONG AGO we set up a time-and-motion-study laboratory in our department here at Northeastern. It has worked out so successfully that we want to pass on the results of our experience to others. We want them to know how we planned it, what equipment it contains, what it cost, and any other details that may help them in doing a similar job. True, it is a college laboratory, but most of the projects carried on it thus far have been actual problems for which Massachusetts industries have sought solution. For that reason we tried to build the same kind of laboratory that would prove most useful in an industrial plant. And we think we succeeded.

In the construction of this laboratory, an attempt was made to combine some of the best features of other laboratories in both private institutions and industry in order to achieve a maximum of efficiency and practicability. Moreover, most of its installations and workbenches were specially designed and built, and have not yet been duplicated elsewhere.

The figure on the facing page reproduces in detail the layout of the laboratory, and the accompanying photograph, showing students at work, displays to advantage some of the laboratory's equipment. Unusual features include a movable camera table, 4 by 5 feet, with an elevator top, for taking motion pictures; two therblig drawing tables, with pencil racks and paper slots, for making "simo-charts"; a circular work-bench* incorporating interchangeable work areas, movable trays, drop delivery chute; a special "measuring table" for indicating distances of hand operations; a bench lathe 9 by 36 inches, completely equipped with tools and fittings for wood and metal working, and mounted on a combination bench and tool cabinet equipped with rollers. This equipment can be made a part of any special set-up or operation under consideration in one part of the laboratory, without destroying its usefulness for building jigs and fixtures for other studies. The laboratory possesses also a bench-model drill press which is used to build special equipment or jigs.

In addition, the laboratory has a sufficient quantity of carpentry and metal-

Selected List of Motion-and-Time-Study Laboratory Equipment [1]

Description	*Units*	*Per Unit*[2] *Cost*
Furniture and Fixtures		
Work tables (masonite top, 39 in. high)	2	$30.00
Stationary benches	2	25.00
Cabinets (with shelves)	2	46.00
Special projector tables	3	5.00
Tool cabinets	1	20.00
Equipment and Machinery		
Miscellaneous wood and metal working tools	..	60.00
Circular workbench	1	50.00
Motion study measuring table	1	40.00
Camera table (with elevator top)	1	25.00
Therblig drawing tables	2	25.00
Lathe on movable table (with set of tools)	1	175.00
Drill press	1	50.00
Keystone projectors	3	25.00
Film splicer set	1	25.00
Special micro-chronometer with three interchangeable dials and case	1	50.00
Cine Kodak camera and tripod	1	130.00
Wide-angle lens 15 m	1	45.00
Telephoto lens	1	40.00
Exposure meter	1	24.00
Victor reflectors	6	3.00
Hooded screens	2	4.00
Time-study boards	25	.50
Decimal stop watches	15	15.00
Hour decimal stop watch	1	15.00
Assembly racks and bins	..	32.00
Adjustable posture chairs	6	6.67
Supplies		
Therblig pencils	3	1.25
600 ft. film	..	36.48
Floodlight bulbs	12	2.00 doz.
Pads time-study sheets	10	.50
Pads time-study analysis sheets	5	.50

[1] This is a partial inventory of the laboratory equipment, excluding many desirable items.

[2] Figures quoted are based on cost at time of purchase or construction (1939).

* FACTORY, Sept. 1936, p. 57.

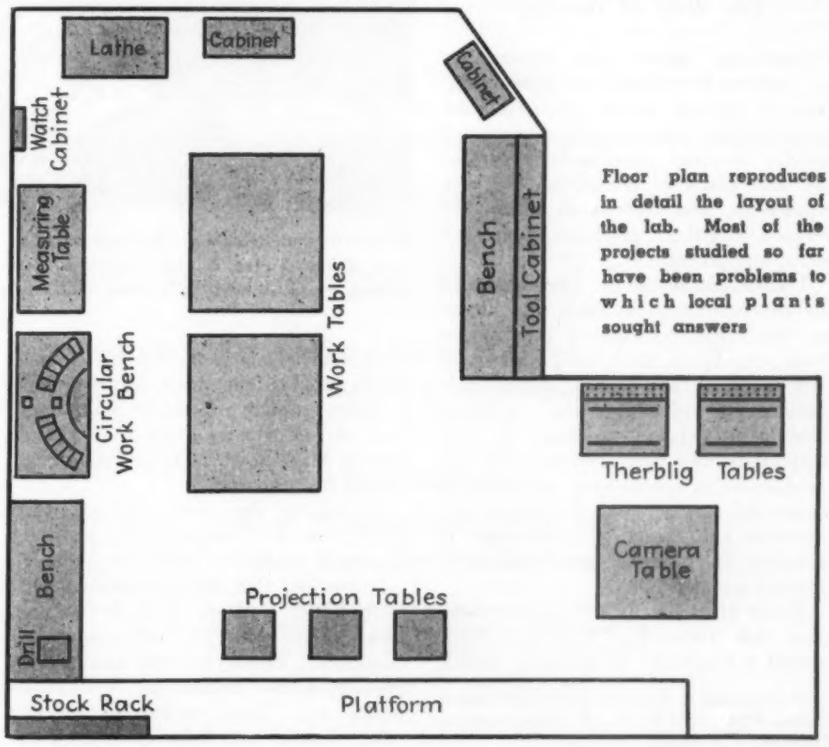
Movable camera table with an elevating top makes it possible to take motion pictures of operations set up at circular workplace

working tools to allow several students to work at once; and carries an ample stock of wood and metals (bar and rolled stock of different sizes, etc.) to facilitate the construction of almost any type of fixture or jig that may conceivably be required in the solution of a motion-study problem.

Made From Tray Bottoms

For time-study work, the laboratory is equipped with hard rubber time-study boards (which can be readily made from the bottoms of rejected cafeteria trays) several types of stop-watches, forms, and other time-measuring instruments.

As a guide to those who contemplate the construction of a motion-and-time-study or methods-engineering laboratory, the table shows a selected list of the items and costs of equipment contained in the laboratory already described. However, the amount that will be deemed essential for any specific laboratory must depend upon its size, purpose, and the number of persons expected to use it at any one time.



Floor plan reproduces in detail the layout of the lab. Most of the projects studied so far have been problems to which local plants sought answers

On Guard Against the Saboteur

Survey your plant now. The saboteur and the spy are abroad in the land. They bomb. They burn. They break. They steal. Your plant may be next. Protect people, buildings, equipment, and materials

OUT OF THE GROWING DEMAND for authentic information on the subject of industrial safety have come some notable contributions to current management literature. Add to them a confidential booklet* compiled by the Federal Bureau of Investigation, which contains suggestions for the protection of industrial facilities. Practical application of these suggestions will materially reduce the effectiveness of saboteurs and espionage agents against American industry.

The methods of the saboteur are many and devious. He works with abrasives, chemicals, bombs. He breaks. He manipulates. Plants must guard against damage to buildings, machines, equipment, power systems, materials, precision tools, finished products. They must look out for bacterial infection or other pollution of water and food for consumption of employees or foodstuffs being manufactured on contract. They must guard against injury to personnel and, last but not least, arson.

The Way of the Spy

Espionage agents seek information on improved methods of production, type of material being produced, rate of production and capacity, quantity of articles on order, specifications, formulas, and plans of munitions and war equipment, test records of newly developed munitions, airplanes, guns, and other equipment.

Tactics employed by foreign agents include infiltration of spies into plants as employees, purchasing information from employees, theft or purchase of stolen plans and other confidential documents, photographing working models or finished products, enticing employees who are familiar with the production of confidential materials to enter the service of a foreign power, pressure and threat with reference to relatives and friends who reside in a foreign country.

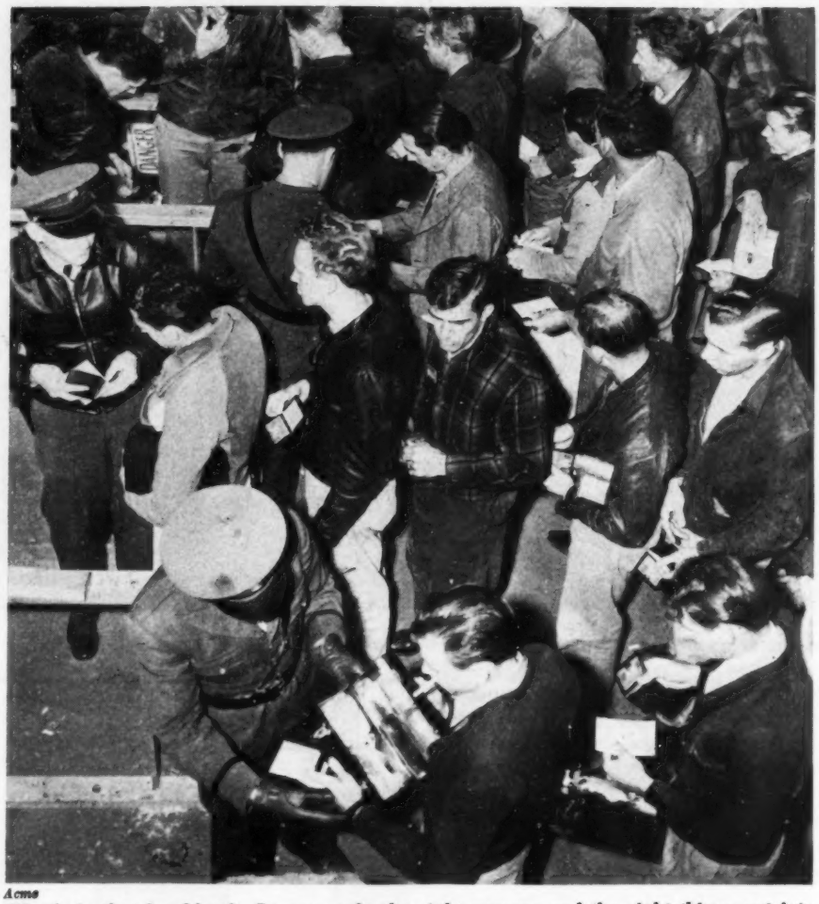
Every plant has its vulnerable points. Just ask yourself: "At what points would a single act of sabotage disable my plant?" Then compile a list of materials, products, or areas that are vital to uninterrupted production and therefore require primary protection. If they cover a large area, maps and diagrams should be prepared.

Include in the survey all fire and safety hazards. Mark them for removal. They may be duck soup for the saboteur.

Remember that disloyal members are in a better position to leave a time bomb in the power plant than any nonemployee. Employees and former employees know where the vulnerable points are. Loyal employees, on the other hand, can help protect plant properties. Why not instruct them as to their duties?

Strict rules must necessarily be imposed upon employees. The supervision to which they are subjected, may tend to arouse a feeling of resentment. An intelligent effort will therefore be made to keep employee morale at a high level. One of the simplest techniques is to convince an employee that the work he is doing is essential to the national defense.

Check absentees. An employee who absents himself without a legitimate excuse is suspect. Movements of employees within the plant should be re-



Acme

What's in that lunchbox? Be sure only the right persons and the right things get into your plant. Vultee Aircraft employees, returning to work after their strike had been settled, are examined by guards, their badges are checked, their lunchboxes searched

* Available to properly authorized executives. Write to FBI, U. S. Department of Justice, Washington, D. C.

Bright light and high fence worry saboteurs not a little. So does the certainty that a well-trained, well-armed plant protection force is aching to take a potshot at them

stricted. Rest rooms or cafeterias will best be located so that employees can reach them without passing through areas other than those to which they are assigned.

Require employees to show credentials when entering the plant. If they enter in single file, the guard can do a better job of checking.

Consider the possibilities of unauthorized persons getting into the plant. Coal chutes, skylights, and fire escapes may be used. Don't overlook water frontage, railroad rights of way, windows that face on sidewalks, storm sewers, unfenced areas. Good fencing, screening, and illumination are the three most important factors in preventing unauthorized entry.

Floodlighting is especially important. Be sure there is light enough inside plant fences to make it impossible for an intruder to gain entry without being readily observed by guards on duty within the plant area.

Provide parking areas for employees' cars—not adjacent to vital plant units. Make it necessary for employees arriving by car to enter through pedestrian entrance. Check contents of all packages carried into the plant.

Make it unnecessary, if you can, for delivery men to enter the plant proper. When it is necessary for trucks to be admitted, establish a truck register. Have the guard at the gate record date and time of entrance, license number, of truck, signature of driver and helper, name of owner, brief descriptions of materials carried in truck, time of departure. Issue a badge to truck drivers; it should clearly indicate that the wearer is a truck driver and not a regular employee.

Why not keep technical and precision tools in a separate room or well-screened area? Loss of such tools or damage to them may retard or stop production. Set up a toolroom control system. Have an attendant on duty at all times. The toolroom is a vulnerable point.

In every plant there are areas where particularly vulnerable facilities exist. They should be considered as restricted. Only people regularly employed in such areas should be admitted to them.

If you have to have explosives, store them where an explosion could cause little damage. Provide a fireproof magazine below ground. Keep it locked. See that guards visit it frequently. Take a daily inventory.

The guard force should be under the direction of a plant official who is charged with the handling of plant protection. In selecting guards, obtain complete information regarding personal history, education, past employment, citizenship, membership in societies and organizations, reputation, and background.

Number of guards will depend on such factors as number of pedestrians; automobile, truck, and railroad gates, and the hours they are open; number of visitors admitted to the plant; wharves to be guarded; patrol beats; restricted areas; vulnerable points, etc.

Guards must be provided with appropriate uniforms and badges. Tours of duty should be considered from standpoint of physical fitness, alertness, and greater efficiency.

All guards should be required to communicate with headquarters at regular intervals. The communication system in use should make it possible for the officer at headquarters positively to identify the voice of a guard calling in, to summon any or all guards on control, to ascertain the location from which a call is being made.

NOW AVAILABLE

Your Plant and the National Production

Published in November. To Help You Test Your Plant's Preparedness

Also available

How Maintenance Can Aid the National Production

A check chart designed to help you get the most out of your plant and equipment. Published as a regular part of December, 1940, FACTORY

Either check chart, 10 cents per copy

How a Small Shop Was Modernized

Small-plant men planning to modernize may find a useful hint or two here

As an old automobile mechanic Frank Roth had so much trouble with valves and other parts that wore down too fast, that he started doing a little research on ways to make these parts stand up under severe service conditions. His experiments got him in so deep that he's now a specialist in applying hard facing, operating under license from a manufacturer of a patented hard-facing material. He's shown in his new office

ANYONE FOND OF "before and after" pictures will get a kick out of two views of the shop of Frank Roth in New York—one taken before he bought it, the other after he'd fixed it up and moved in.

This little plant—15 to 20 men are the most ever employed—is a good example of how the small plant can be modernized. All it takes is a little pride in how your place looks, a little thought of what you want, and a willingness to spend some extra money which, once you have the job done, you'll consider well invested.

This plant does hard facing, applying a special hard material to metal surfaces that are to be subjected to severe wear. It had been getting along pretty well in much smaller, very ordinary quarters not far from the present site, but a growing volume of work started to cramp activities. So they began looking around, found this place, an old automobile repair shop, and bought both it and an old wood frame house next door.

Renovating the shop was really quite simple. Its cement block construction with a brick front lent itself readily to the purpose. The only major alterations were to put in new metal sash windows, replace some ornamental brick parapets with straight stone coping, substitute glass brick for a plate glass window, and put in a new upward-sliding door. Then the whole place, inside and out, was painted white.

Although a five-foot gray dado is customary in painting industrial interiors, they elected to paint the wall white right down to the floor, in this way taking maximum advantage of the white paint's high reflectivity.

The old house was torn down, and in its place a two-room office building matching the made-over shop was constructed, with an enclosed corridor to connect office and shop. Metal sash windows went into this office building, just as they did into the shop, and the exterior was painted white to match the shop. To dress up the interior, both the outer reception office and the inner private office were paneled with knotty pine.

When it came to the layout, all production machines—lathes, milling machines, and the like—were placed along the walls. General utility machines such as tool grinders and cut-off machines were set up in the center of the floor where they are convenient to all operators, who have only to turn around and move a few steps when they want to sharpen a tool or cut off a piece of steel.

Special Attention to Lighting

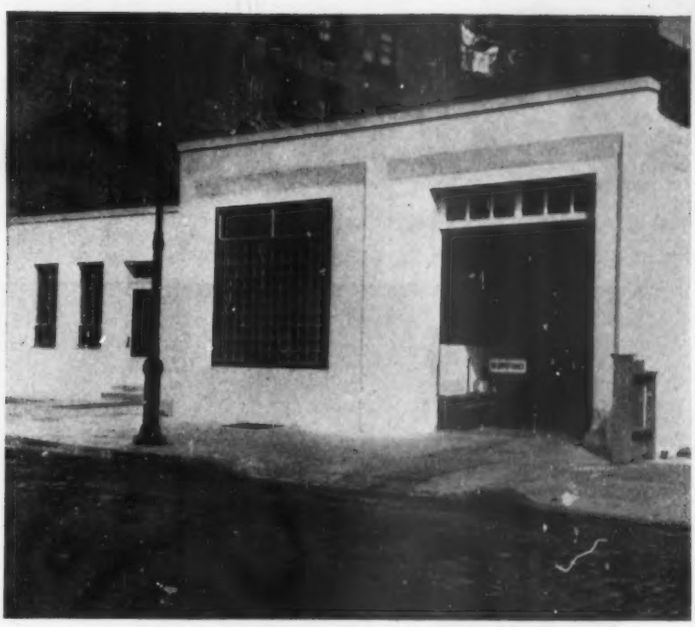
Plenty of diffusing-glass windows and two skylights give ample good light, but to insure sufficient light at all times, on dark, cloudy days and at night, mercury units give more than enough soft general illumination. As supplements to this general lighting, local lights are provided at each machine and have been installed at other work places in the plant.

For heating, two large thermostatically controlled unit heaters, one on each side of the shop, keep the shop at comfortable working temperature on the coldest days. On hot summer days the blowers in these heaters are kept going to keep air circulating and maintain comfortable working conditions. The office is heated by a gas furnace in the basement.

To keep walls and floor from becoming cluttered with conduit, power lines were sunk in the floor. And a couple of extra lines were run where they can be easily tapped when additional machines must be installed. Water lines for supplying coolant to the machines were handled in the same manner.

In describing the major alterations made to the building, no mention was made of the furnace room. After applying the hard-facing material with oxy-acetylene torch, it must be heat-treated; both of these operations are noisy and give off considerable heat. So one corner of the shop was walled off with

BEFORE. A rundown automobile repair shop and an old house



AFTER. Face-lifted shop matches building replacing house

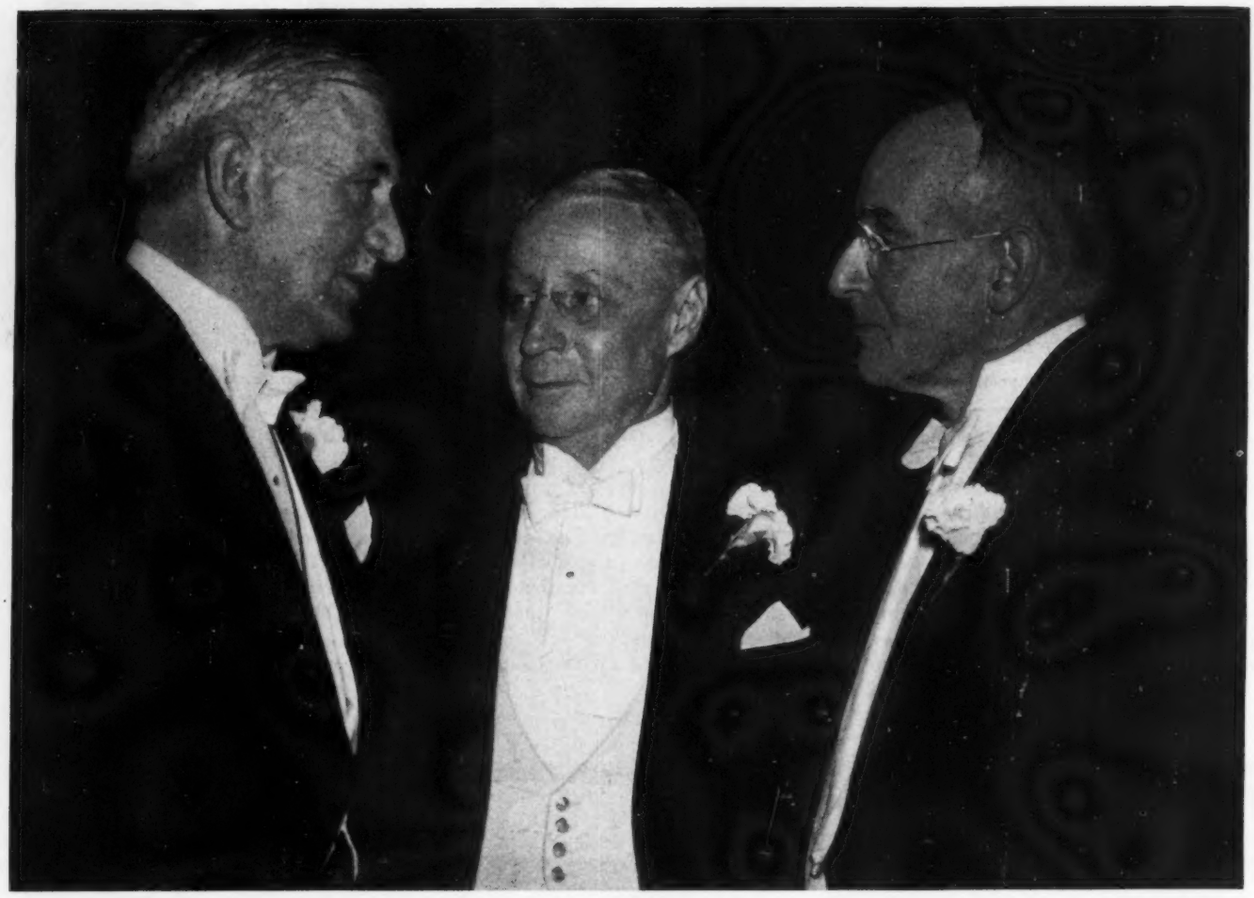
building tile for what is called the furnace room. It is adjacent to the receiving area, so that parts coming in for hard facing move right from receiving to the furnace room, where the first steps in the process take place.

Handling is simple but suitably provided for. Just inside the receiving door is an elevating platform, hydraulically operated, which can be raised to the tailboards of incoming trucks. Crates and boxes can then be slid off onto this elevator which can either be lowered immediately to the shop floor, or left in its raised position while shipments are opened, inspected, and unpacked onto shop trucks. The latter are two-tiered flat trucks of special design, on which parts are placed so that operators can conveniently pick them up, work them, then set them back on the truck again ready to be moved to the next operation.

To finish off the job, grass seed was sown all around the yarn; there is now a fine green lawn out behind the shop. A chain link fence around the property protects the property from vandalism, burglary, and damage to the lawn. And there's just one final item that should be mentioned—in the basement of the office building there is a room for which no provision has been made. It is hoped that this room can be made into a recreation or club room for employees' use after hours.

Building features include steel-sash windows, skylights, mercury lighting units, unit heaters. There's plenty of elbow room, too

Knudsen Warns Against t



At NAM's 45th Congress of American Industry. Left to right, William Knudsen, production chief of the National Defense Advisory Commission; H. W. Prentis, Jr. (Armstrong Cork), retiring president of NAM; Walter D. Fuller (Curtis Publishing), new president

We are way beyond worrying about the cost. Important thing now is to get this job done. Thus the defense production chief to National Association of Manufacturers

DESPOTIC POWER we abhor, but we must recognize that it compels the exercise of certain qualities which we must voluntarily exercise if we are to prevail in times of conflict. Among these qualities is concentration on definite objectives with singleness of purpose. We are a peaceful people. The ways of war are foreign to us. Our industries are now being organized for national defense which, to be effective, must be capable of the maximum of resistance to attack.

EDITOR'S NOTE: Mr. Knudsen's address is published here in part only.

You have read about the billions of dollars of orders which have been placed with thousands of contractors and subcontractors all over the country, and perhaps it might be well if I gave you a quick description of what all this money means in units. In round figures it means 50,000 airplanes, 130,000 engines, 17,000 heavy guns, 25,000 light guns, 13,000 trench mortars, 33 million shells loaded, 9,200 tanks, 300,000 machine guns and ammunition, 400,000 automatic rifles and ammunition, 1,300,000 regular rifles and ammunition, 380 navy ships, 200 mercantile ships, 210 camps and cantonments, 40 government factories, clothing and other equipment for 1,200,000 men.

I have included with these quantities such British and other foreign material placed at the present time. The program with all its subcontract and equipment features is large and is conservatively estimated to require about 18 billion man-hours. When we consider this addition to the regular production in the United States and realize that the larger percentage of this load lies in the heavy goods industries, we are confronted, because of the time element involved, with the greatest production problem of any country in modern times.

The three factors involved in this problem are the government as the customer, and industry and labor as the sellers. Behind the government is the all-powerful force of the country's

st the Friday to Monday Blackout

will and the all-important public opinion which must guide our actions in order to accomplish a successful result.

In my earlier talks on the problems of defense I stated that initially the defense load would be superimposed on the regular business of the country until it became necessary to adjust. The simple reason for this was that the contracting and tooling-up period would not absorb employment which might be made idle by trying to restrict regular business during this tooling-up period. You are all perhaps familiar with the initial obstacles which had to be cleared away, such as appropriations, rapid depreciation allowances, and the plant facilities contract. All these have been cleared away, and contracts have become a much simpler matter as far as procurement is concerned. I think we are successfully meeting the demand for spreading the government plants to localities where surplus labor and skill is available. We haven't by any means satisfied everybody, but an honest attempt has been made to meet this part of the problem the best way. The orders are more than 85 percent placed.

What can I then consistently ask for now? The defense job to my mind has not as yet been sufficiently sold to industry and labor. The public generally is sold on defense—letters that I get and word-of-mouth information that I get clearly indicate that the man in the street is for defense 100 percent and wants to see a lot of material turned out before he feels secure. But have the two most important elements, industry and labor, been fully sold on the serious side of the job?

Friday night has become the big night in most of our industrial picture. It used to be Saturday night—we have cut 20 percent off our machine time. Can we afford to do this? Can't we stop this blackout, this lack of production, from Friday to Monday and get more use out of the equipment? We can train the men to operate it. Isn't it possible to put the defense job on a war basis even if we are at peace?. When I think of the seriousness of the whole world situation, I wonder if we are not justified in doing just that. Have we done everything we can to utilize existing facilities and offer them to companies having defense contracts? Can we subcontract more of our work and spread it so as to make speed and more speed that way? Every manufacturing concern that has a defense contract should be informed of idle facilities in the locality so as to confine the new equipment as far as possible to special machinery.

I don't know whether we have done a job yet in helping labor to get the proper understanding of what this defense job means to their future and their country's future. When I look over the trend in the occupied countries in Europe, America is about the only spot left where law prevails and where the man at the bench has a chance to make his way without clicking his heels.

We all seem to be worrying about how we are going to divide the profits without giving consideration to the fact that we ourselves have to furnish the price to buy the materials with. We hear so much about all the things that ought to be fixed right now. We read resolutions from every direction. It is my sincere hope that we will, as far as humanly possible, try to wipe out whatever differences there may be that do not depart from principles guaranteed us by the law of the land. The only way to get this program going is to get a concerted effort and a cooperative effort—an incentive fired with the spirit of sacrifice from everybody from the bench to the manager's desk. If we can accomplish this, our program is finished.

I am wholly in sympathy with the rights of labor. I am happy to see the published expressions by labor of their

(*Continued on page* 156)

THE FUTURE OF AMERICA

The "Platform of American Industry" adopted by the 45th Annual Congress of American Industry

THE CONGRESS of American Industry meets this year profoundly conscious of the dangers which confront the nation in a world torn by war and revolution. The American people in all walks of life—farmer, factory worker, housewife, lawyer, saleswoman, executive, clerk, and shopkeeper—all are deeply concerned as to the future of America; the future of themselves and of their children.

Our country is challenged from abroad, but still at peace. It is perplexed by continuing problems within which must be solved. Our people are united in their purpose to make themselves so strong that their liberties and their way of life may be preserved.

We recognize the vital part that American industry must play in securing the strength and welfare of the nation.

Industry, in the broadest sense, is America at work. It is the production of goods and services by millions of men and women working on farms, in mines, in factories, in offices, in shops. It is the American people themselves who make industry. They provide the capital, they furnish the labor, they consume the output. All have a vital stake in the process.

Well-supported churches, well-equipped schools, comfortable homes, busy stores and offices, all depend upon busy farms, mines, and factories. The people, in order to maintain their standard of living, want the goods and services that industry can produce. But today they are demanding, in addition, the goods and services with which to build defenses so strong that the nation will be safe against foreign aggression.

It is upon industry that the people must depend if the goods and services for both of these purposes are to be produced. It is to the free enterprise system that the people must look if the nation's defenses are to be provided in a manner which will preserve, and not destroy, the way of life they are designed to defend.

The task before us in America is twofold: First, *to safeguard our freedom*, by providing our military defenses, by strengthening our economic defenses, by fortifying our moral and spiritual de-

(*Continued on page* 162)

We Show Customers' Operators How

This concern is not content just to build high productivity into its product. It goes a step further—into customers' plants to see that men make machines do the jobs they are capable of doing

CLIFFORD S. STILWELL

Executive Vice-President
The Warner & Swasey Company
Cleveland

FOR MANY YEARS our company, like other manufacturers of production equipment, has been concerned over the fact that the operators of our machines in customers' plants were in many cases failing to get out of the machines all the productivity and the high quality of performance built into them.

Knowing what our turret lathes could do in the hands of fairly competent operators, we realized that many of our customers' machines were not measuring up to what we considered satisfactory performance.

There was only one answer. The operators of these machines were not using latest methods on their jobs. In the grinding and setting of cutters, in the use of tooling equipment, in the selection of speeds and feeds, in the taking of cuts, they were missing little points that in the aggregate were important. These operators were not making major errors—but in a hundred small details were slipping up just enough so that they were not getting the largest possible amount of work or the best possible quality.

There was no reason, of course, why this should continue to be so. High quality and productivity were built into the machines. It was just a question of getting the fullest performance out of them—a question of knowing how every detail of turret-lathe operation should be handled to make the machines do the job they were capable of doing.

Left to Get Along

We can hardly blame operators for this situation. Many of them were never given any instruction in the newer techniques. Many were trained on older equipment and then left to get along as best they could when later put to work at newer and vastly improved equipment. Moreover, there hadn't been a book printed in fourteen years that was devoted exclusively to turret-lathe operation. Certainly we couldn't expect every operator to be just as expert in the handling of turret lathes as our own engineers.

At the same time we were convinced that every operator wants to do the best job possible. It seemed, therefore, that if we could devise some plan whereby turret-lathe operators the country over could learn the basic principles and the finer points of their work, they would certainly welcome the opportunity.

We felt sure, too, that our customers would be interested in this idea—since anything we could do to increase the skill and output of their men would actually add just that much more to the capacity of their plant and the quality of their product.

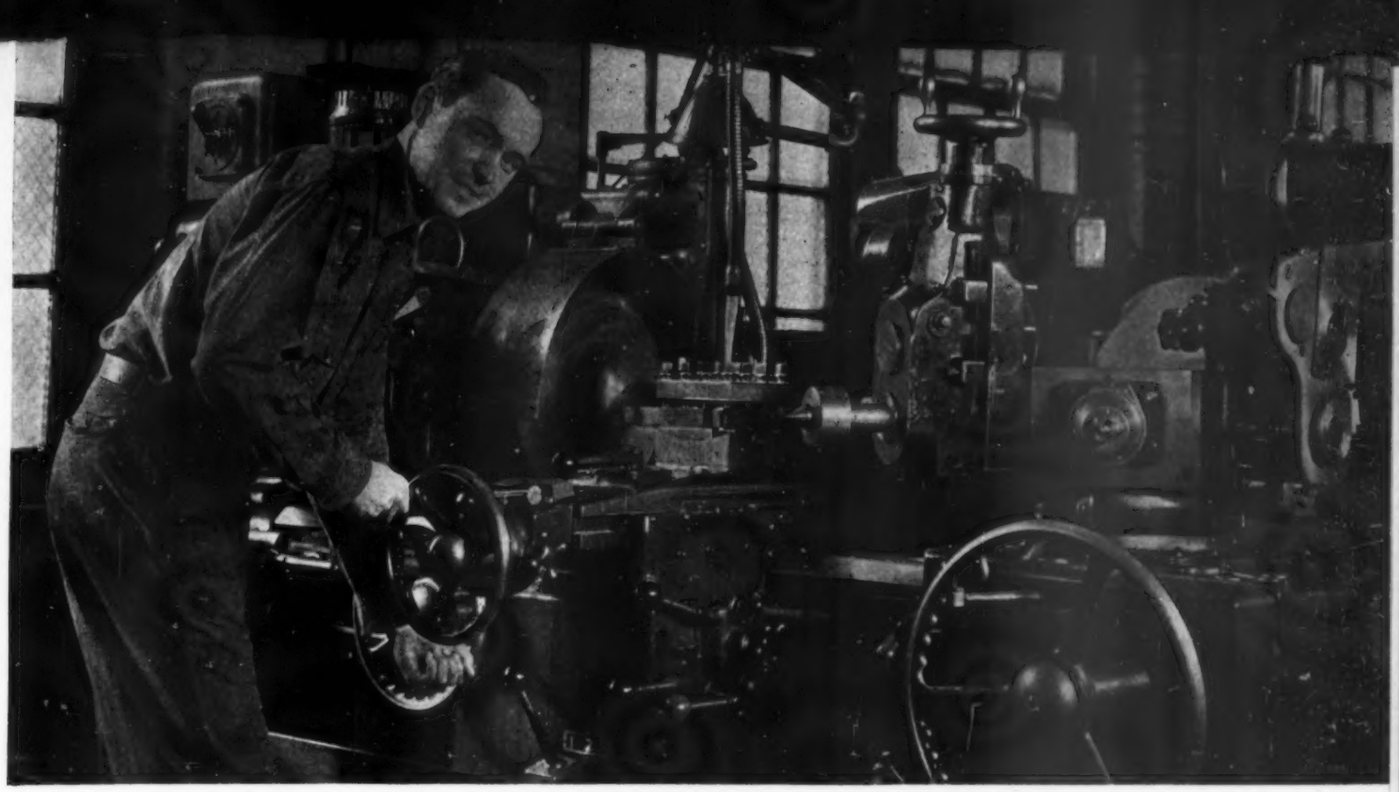
The result was the development by our company of a program for the further education of turret-lathe operators in the handling of their machines. The program involved the development of the following:

1. A monthly publication devoted exclusively to the problems of turret-lathe operators and serving as a medium for the exchange of ideas—a publication sent by mail (without charge) to operators who subscribe to it.

2. A sound-slide film and a series of charts which form the basis of a lecture on turret-lathe operation delivered to groups of operators in customers' plants.

3. A comprehensive 240-page manual

Scene from 20-min. sound-slide film shows what a shop looked like in grandfather's day



Another scene from sound-slide film depicts modern shop; the narrator contrasts today's working conditions with those of yesteryear

which contains complete information on all phases of turret-lathe operation—a volume that can be used for home study as well as classroom work.

These three arms of the program have been coordinated under what we term our "Turret-Lathe Operator's Service Bureau" and this bureau now constitutes a distinct department of our company's activity.

Although no one could foresee it when the idea was first being developed, this program has now been skyrocketed into a position of special significance because of the national defense program. With defense requirements taxing to the utmost the productive capacity of the machine tool and similar industries, it is of course of vital importance that operators be capable of the highest type of skill and workmanship in order that manufacturers may get maximum results from their equipment.

For this reason it occurred to us that a detailed description of our operator's educational program might be of interest to industry in general since the same technique we have used might be equally applicable to other types of equipment.

I like to think of this program in the same terms as those ordinarily applied to any manufacturing enterprise—in short, in terms of equipment, operation, and product.

1. Equipment

"Blue Chips." This is an unpretentious publication 8½ by 11 inches in size, sometimes of 8 and sometimes of 4 pages. Its contents consist entirely of specific suggestions as to how to do certain things or handle certain problems in turret-lathe operation, much of the copy being contributions written by operators themselves.

For instance, one issue includes discussion of threading studs, cutting grooves in long holes, spherical turning, positioning the turret, turning a diameter concentric with a thread, tapping nuts, the single cutter turner, a Universal chucking set-up on bushing jobs, and adjusting the hexagon turret binder.

The publication is illustrated with pertinent photographs and charts or diagrams. The latter are particularly effective because unessential details can be omitted and the particular point in question played up.

Operators receiving "Blue Chips" are encouraged to send in their own suggestions and shortcuts and improvements that they have learned about or themselves developed. They have responded liberally to this invitation; suggestions come in regularly from all parts of the country. Contributors are paid $3 for each item used.

Slide Film and Chart Series. In preparing the material for the lecture given to operators in customers' plants, the problem was to select out of the mass of material available those subjects that would prove most valuable for the purpose.

The result was a sound-slide film which runs for 20 minutes, followed by a series of 50 charts which form the basis of a 40-min. talk delivered by one of a group of our men selected for this assignment. Explaining basic principles of their work to operators requires a carefully planned technique because many of these men have had long experience and may perhaps feel that they already know practically all there is to learn on the subject.

The talking-slide film first contrasts the turret lathe of grandfather's day with the turret lathe of today, bringing home to the operators how much better the tools and the working conditions of today are than the tools and the working conditions in the industrial plant of only half a century ago.

Next the slide film shows the manufacture of turret lathes in the Warner & Swasey plant. This is for the purpose of showing operators what is built into turret lathes—in order that they may better understand what should and can be got out of their machines.

When the slide film is over, the Warner & Swasey "lecturer" sets up the series of charts, 32 by 40 inches in size, and uses these charts in sequence to illustrate his lecture.

The object of these lecture charts is three-fold:

1. They serve to visualize the points made by the lecturer.

2. They hold the lecturer to a definite sequence of thought, thereby making his job easier and also assuring a concise and standardized presentation.

3. They help the men attending the lecture to organize their thinking on this whole question of turret-lathe operation along constructive lines.

The charts divide the entire subject matter into ten distinct classifications. These emphasize the following points:

(1) Use proper speeds; (2) use correct feeds and depths of cut; (3) use a Universal set-up; (4) grip the work properly; (5) combine cuts; (6) use the best cutter grind; (7) support the cut; (8) know how to get accuracy; (9) take care of your machine; (10) keep modern.

The charts are drawn in a semi-cartoon style with little human figures to help bring home the argument and at the same time inject into the series an element of humor and informality. From a technical standpoint the charts are scaled down to bare essentials and simplified to the last degree.

We cannot hope to tell each turret-lathe operator every single thing he ought to do in connection with every possible job. But even in a 1-hr. presentation we believe we can give him an approach to his job that will enable him to tackle any situation more intelligently and in line with basic principles.

Turret Lathe Operator's Manual. The manual, as we have indicated, turned out to be a comprehensive treatise. Designed primarily for men now working on turret lathes and therefore already familiar with a great deal of the subject matter, the manual nevertheless goes back to first principles in an endeavor to pound home fundamentals.

On the other hand, in later chapters it explains some of the engineering principles underlying good practice, and to that extent goes beyond the limitations of a mere working manual. In short, although designed for turret-lathe operators it has likewise proved of value both to technical high school students and to graduate engineers.

After discussing in early chapters the several types of turret lathes and the principal parts of typical machines, the book takes up the two all-important elements that distinguish good machine tool operation: (1) Use of proper speeds and feeds; (2) proper grinding and setting of cutters. Because so much of the inefficiency in the hour-to-hour operation of turret lathes is due to failure to run machines at just the proper speeds and feeds, and to grind the cutters at just the proper wedge and clearance angles, a great deal of emphasis has been given these two subjects.

Chapters 7 to 13, inclusive, deal with the problems of bar turning, drilling, boring, reaming, forming, threading, and taper turning. The subject of work-holding devices is taken up in chapters 14 to 17, and the next five chapters are devoted to the problems of actually tooling and running turret-lathe jobs. First very simple, then more and more difficult, jobs are analyzed until the series is climaxed by a study of tooling jobs that require completely special equipment. Actual jobs are used in every case, and the method of arriving at the best tooling set-up is shown. The last chapter is on estimating. Ample use of photographs and drawings helps to illustrate all the important details. Every 2-page spread in the book, except at the end of chapters or where tables are given, is illustrated.

2. Operation

So much for equipment. Now comes the question of putting this equipment to work in such a way as to make it really productive.

With "Blue Chips" this was a comparatively simple matter. We sent the magazine to a list of turret-lathe operators. We also told shop superintendents and production executives about it. The result was automatic. Requests to be put on the mailing list began to come in regularly. The magazine goes to the operators at their homes.

The mechanics of setting up the lecture with the slide film and the charts presented more of a problem. The standard procedure that was worked out and has proved satisfactory is the following:

We present the idea to a plant manager, works superintendent, or whatever office of the company is most directly concerned with plant operation. We explain to him just what the lecture is and why we want to put it on. In practically every case the reaction of the executive thus approached has been one of immediate and complete cooperation.

He usually arranges for the lecture to be put on in some room inside the plant or the factory office. Important considerations include getting enough chairs for all the men who will attend, getting satisfactory wall space on which the slide film can be shown, and getting far enough away from factory noises so the lecturer's voice can be easily heard.

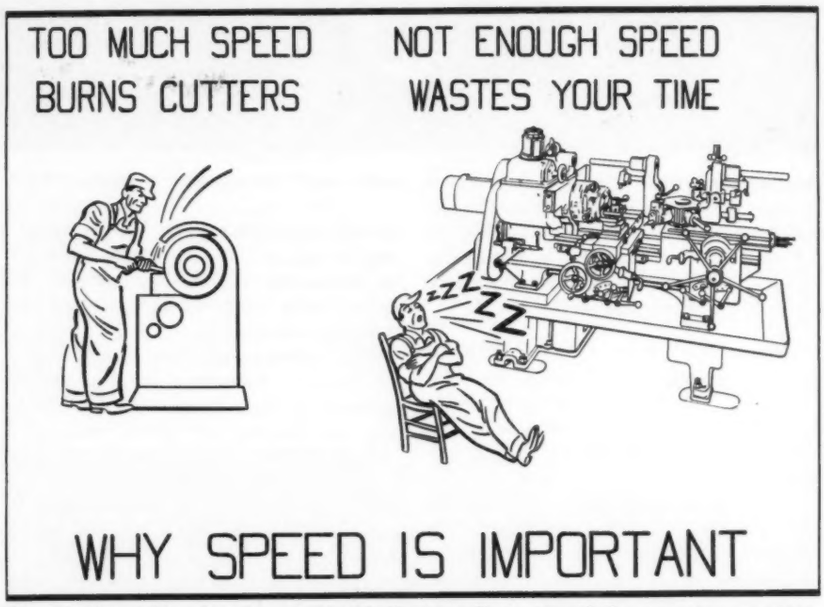
We have put this lecture on under all sorts of conditions in all sorts of rooms and have found that, barring unusual difficulty, it is on the whole practical to hold the lecture somewhere inside the plant. Of course, now and then we run into a little trouble, such as we did once when the shop mascot (a dog with an unusually lusty voice) began howling in the middle of the lecture and finally had to be tied up outside.

If there is no place in the plant where the lecture can be put on, the meeting is held in any available auditorium or hotel room.

Often turret-lathe operators attend the lecture on company time. The shop superintendent, or some other executive of the company, notifies the men and at the time set they simply step from their machines into the room selected, and the show goes on. The interesting angle of this procedure is that company executives consider the lecture of so much value that they are willing to give up an hour's turret-lathe production for it.

Of course the lecture is not always given on company time. When no room in the plant is available and the lecture is put on in a hotel room or in an audito-

(*Continued on page 158*)

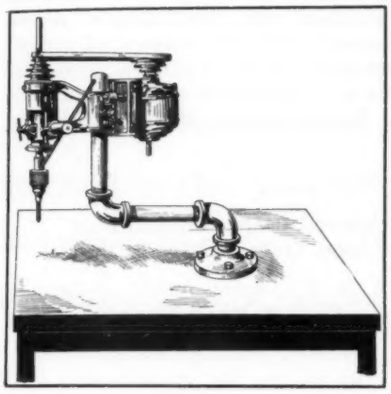


One of 50 exhibits that form basis of 40-min. talk to turret-lathe operators; cartoon style helps drive the points home, injects element of humor and informality. Folder distributed at lecture has latest information on speeds and feeds and cutter grinding

Management Shorts

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

PRODUCTION METHODS AND MATERIALS



Extension Arm Gives Drillpress Wider Range

OLIVER MANN, *Danvers, Mass.*

We had two drillpresses mounted on pedestal bases, with removable heads. An occasion arose where we had to drill a large number of panels which, because of their area, were beyond the range of any of our equipment.

I took a section of pipe about a foot long, and turned it in a lathe to a diameter to fit the head of the drill. An elbow was used to join this pipe and another piece of pipe that had been cut long enough to give us the range required. This pipe section was in turn fitted to a second elbow joined by a close nipple to an extra-heavy floor flange. With through bolts this flange was secured to a work bench.

Now any of our drillpresses can be mounted on this flange. So valuable do we find this arrangement that it is left set up all the time, ready for use.

•

New Insulation Saves Time and Oil

SOURCE
Quigley Company, Inc.
New York

A manufacturer of mason's tools replaced the firebrick previously used in a heat-treating furnace with 4½ inches of light-weight, cellular, refractory brick backed with 2½ inches of a light-weight, cellular, block insulation. It is now possible to bring the furnace up to temperature in 15 minutes, whereas with the former lining one hour was required, using a larger oil burner tip.

•

Finger-Lift Trucks Cut 20 Manhours to 1½

SOURCE
Clark Tructractor Division
of Clark Equipment Company
Battle Creek, Mich.

At a lead smelter, lead was received by rail in pigs weighing 90 to 100 pounds, unloaded on factory trucks, towed by tractor to storage yard, unloaded and piled in storage by hand. When needed in production, the pigs were again loaded by hand on trucks, pulled by tractor into the plant.

Application of the finger-lift-truck method of handling materials was tried. Incoming lead is now cross-piled, five pigs to a layer, six to seven layers to a stack, and removed from the car by a power truck. No skids are needed because the first layer of pigs in each stack is laid so the forks can slip under the pig ears. The stack is carried to storage where its unit form is kept intact so that, when needed in production, the operator can pick up the stack, transport it to the plant, and deposit it where needed without dismounting from his machine.

By the former method of manual handling, it took 4 to 5 men from 5 to 6 hours to unload a car of metal—20 to 30 manhours.

•

Carton Stamping Time Cut to Fraction of Former Figure

JAMES F. RABAS, *Stores Supervisor*
Globe-Union, Inc.
Milwaukee

We have speeded up the stamping of part numbers on small cartons by the use of an addressograph. We chose a model adaptable to foot pedal operation and convenient for guide mounting. We had been using a small printing press but the time required for set-up was too high and time was lost waiting for the ink to dry.

We have about 900 stock items that

Installation of three stapling machines saves $5,000 a year on this carton-sealing job

are put into similar cartons. We cut addressograph plates for each and filed them into regular trays in numerical order. This cabinet was placed next to the machine. We were able to cut the set-up time from 9 minutes to 30 seconds and the time for stamping 100 cartons from 11 minutes to 1.8 minutes. The cartons can be used at once. Colored ribbons may be used to blend in with the carton color combinations.

This method of stamping cartons is especially adaptable where a large variety of items go into the same or similar cartons, where preprinting would be too expensive because of large inventories and involved control. With very simple adjustable guides, numbers can be stamped within $\frac{1}{16}$ inch of the place desired, with little spoilage.

EMPLOYEE RELATIONS

Girls with serving cart bring office employees tea without disturbing office routine

Rest Period Tea and Coffee "Picks-Up" Employees

SOURCE
Jewel Tea Company, Inc.
Barrington, Ill.

In this plant there are regular rest periods at 9:45 a.m. and 2:30 p.m. Workers gather at given distribution points for tea and coffee. Occupied with more strenuous physical work, the plant employees have noticed an even greater pick-up and refreshment than office employees. The loading floor workers who spend considerable time outdoors look forward to a warm beverage with anticipation during the winter months.

In the office, the 165 office employees are served coffee or tea twice a day also, mid-morning and mid-afternoon. Two young ladies operate a special serving cart which carries a complete supply of cups, saucers, spoons, cream, sugar, coffee, and tea. Each employee is supplied with a ticket on which requests for sugar and cream, tea or coffee, can be noted. This eliminates the necessity of conversation. Thirty minutes after serving, the empty cups are picked up. There is no disturbance of office business.

Donald Laird and other psychologists have studied the efficiency trend of all types of human workers. Productivity rises to a peak at mid-morning, then hits a plateau or recedes until lunch time. The refreshment of a pause and a new supply of food energy combats the pre-lunch recession of productivity. A hot beverage at three o'clock in the afternoon, likewise, effects a more fruitful final quarter of the day.

Jewel officials tried mid-morning and mid-afternoon beverages, and knew from experience that there was truth to what the psychologists recommended. They themselves had felt increased energy from the beverage pause. Accordingly, they made tea and coffee available to all twice daily.

•

Colored Prepositioning Bins Speed Training, Production

E. H. SCHAEFFER, *Industrial Engineer*
J. E. Ogden Company
Bayonne, N. J.

By coloring the prepositioning trays on hand assembly work we have shortened training time and increased production on some operations.

These trays are colored in contrasting colors which serve as a means of assist-

(*Continued on page 170*)

Management, How Good Is Your Control?

Ask yourself these questions to check up

5. HOUSEKEEPING

1. Are you satisfied with housekeeping in your section? Can you improve it?
2. Is maintenance doing its share? Are you doing your share?
3. Are scrap metal and refuse boxes used, or are metal scraps and trash thrown indiscriminately about on the floor?
4. Are scrap metal boxes used for scrap metal disposal only? Or are they allowed to become full of lunch refuse and trash?
5. Are there enough trash cans? Clearly marked? Located conveniently?
6. Is space under benches kept clean? Under and on top of parts storage racks? In and on top of cabinets? Around and behind machines? Under floorboards? The floor of the section in general?
7. How often do you inspect for housekeeping? What do you do about it?
8. Are lunch boxes, tool boxes, tools, small parts, personal clothing stowed neatly in specific places, or are they scattered around?
9. Where is lunch refuse disposed? Is this disposal satisfactory?
10. Are there cleaning rags lying around on machines, under machines, on or under benches or storage rack shelves?
11. Are benches equipped with prepositioned dust brushes?
12. Is your own desk neat and businesslike? Are papers collected in one central place and systematically and regularly filled?
13. What condition are tool drawers in? How often are they cleaned out?
14. Is cleaning unit kept neat? Or is it run without close supervision?
15. Are tool boxes kept together, in a few central locations—preferably off the floor or in a dead space where they will be out of the way?

Next Month: Personnel Relations

Prepared by HARDING PALMER, *Industrial Engineer*
Lockheed Aircraft Corporation, Burbank, Calif.

MAINTENANCE SERVICES

SELECTION

INSTALLATION

INSPECTION

UPKEEP

ORGANIZATION

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FACTORY MANAGEMENT and MAINTENANCE

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

EDITORIALS

L. C. MORROW . . . *Editor*

This Year Maintenance Will Set New Standards

PROBLEMS and responsibilities of maintenance increased many fold during the year just past. So far as can be seen they will be multiplied, rather than decreased, this year. Therein lies a challenge and opportunity for those who can successfully meet them.

New plants are being built by the score. Into them are going hundreds of millions of dollars' worth of new machines and equipment. Selection of much of this new equipment, and installation of virtually all of it, are among the serious responsibilities dumped into the lap of maintenance. Afterward comes the equally important and never-ending task of keeping this equipment in tiptop condition, along with the buildings and services of every kind.

To discharge these duties properly requires experience, sound training, and executive ability of a high order.

Industry has now been called upon to produce vast quantities of war matériel. It must also provide the countless goods and services needed to maintain the American standard of living. In this vast program maintenance plays an indispensable part. Failure of either management or maintenance to recognize that important fact cannot fail to have serious consequences.

Under today's conditions maintenance cannot afford to waste time on inefficient men or tools, outworn methods, or ideas that were good enough ten years ago.

Men and methods will be tested as seldom, if ever, before during the coming months. The maintenance department in thousands of plants will have a brilliant opportunity to show what it can do under emergency conditions.

Farsighted maintenance executives will seize this opportunity to put their function on a still higher plane by establishing new standards of efficiency and service.

Don't Let Sprinklers Get Too Hot

SPRINKLERS ARE DESIGNED to open when the surrounding temperature goes appreciably above normal. Since they have no choice in the matter and cannot discriminate between the rise in temperature caused by a fire and that due to a unit heater or oven, say, they may open unexpectedly and cause considerable damage.

There is little excuse for such occurrences, which reach their peak in the coldest weather and in summer. The remedy is simple and lies in making sure that all sprinklers are of the proper temperature rating. It is well known that they are available for operation between about 135 and 500 degrees Fahrenheit. There is sometimes failure to realize, however, that the solder tends to soften and may allow links to separate gradually at temperatures considerably below the melting point. Hence a margin approximating 60 degrees must be allowed between normal temperatures and the temperature rating of solder-type sprinklers. With other types the necessary margin is less—about 35 degrees.

When sprinklers are installed their rating and the local temperature should be checked to make sure that the two are properly matched. A repetition of this check whenever equipment is installed or changes are made that may expose sprinklers to higher temperatures is the cheapest kind of insurance against water damage and loss of production.

Treating Signs of Trouble Doesn't Remove Causes

CERTAIN PUMPS were known to require too much maintenance, but nothing was done about it for a long time. Then the maintenance chief became curious and soon found out that the trouble lay in the use of the wrong kind of packing.

Application of the obvious remedy saved the company hundreds of dollars a year and lightened the burden on a very busy maintenance department.

Leather belts used in one department of another plant had to be taken up frequently and lasted only about two years. When it was realized what these conditions were costing an investigation was made which showed that abnormally high temperatures in this department were the cause of all the trouble.

Special-tannage belts designed for temperatures higher than normal were installed—and that problem was licked.

What do such incidents mean? Simply that there is oftentimes failure to make an intelligent effort to clear up the basic causes of trouble. The result is that the maintenance department spends much more time and money in patching up and replacing than would be necessary if a real effort were made to find out why trouble occurs.

No maintenance department can afford to waste time or money. A good way to avoid such waste is to keep complete records of all work done, watch these records closely, and run down the causes of troubles that recur.

Incentives Cut Pipefitting Costs

Standard allowances based on time studies made under different conditions are set up for each job. Result: men work efficiently, earn more, need less supervision

P. M. MATTHEWS and C. H. BRECHIN

Factory Service Division
Westinghouse Electric & Manufacturing Company
East Pittsburgh

Factors on which this pipe welder's incentive is based include type and size of pipe and fittings he welds, working conditions, safety, preparation time required

APPLICATION OF INCENTIVES to maintenance pipefitting has resulted in a decided decrease in the cost of supervision for such work. On the other hand, the men have increased their earnings because of improved performance.

When incentives were first considered, it was contended that this type of work is too variable to be measured with sufficient accuracy. An investigation disclosed some complex problems from the standpoint of time measurement. This fact, however, formed the principal reason for the need of measurement, so that the management could control its costs and the men receive compensation commensurate with their industry.

Extensive time studies were taken covering all phases of the work, and where possible standard methods of performing work were formulated. In considering means of computing time values it was found that as usual there are definite constants and variables that can be associated with the details of the installations. For example, the three kinds of piping handled—standard, hydraulic, and cast iron—have a decided effect upon the cutting and threading time due to the various thicknesses, and some influence on the handling time because of variations in weight.

Other Factors

Diameter and length of pipe to be installed and the size and number of fittings to be used are other factors. The place where the pipe is to be installed—that is, whether in a ditch or under the floor, at floor level, or overhead—is particularly important. It is obvious that these last factors will govern the handling and installing time to a large extent. All methods of fastening and supporting had to be considered and studies taken covering the making of various special-type supports and hangers which cannot be purchased. The same was true of all types of bends. Here again constants and variables were derived covering the size and gage of pipe, hot and cold bends, types of

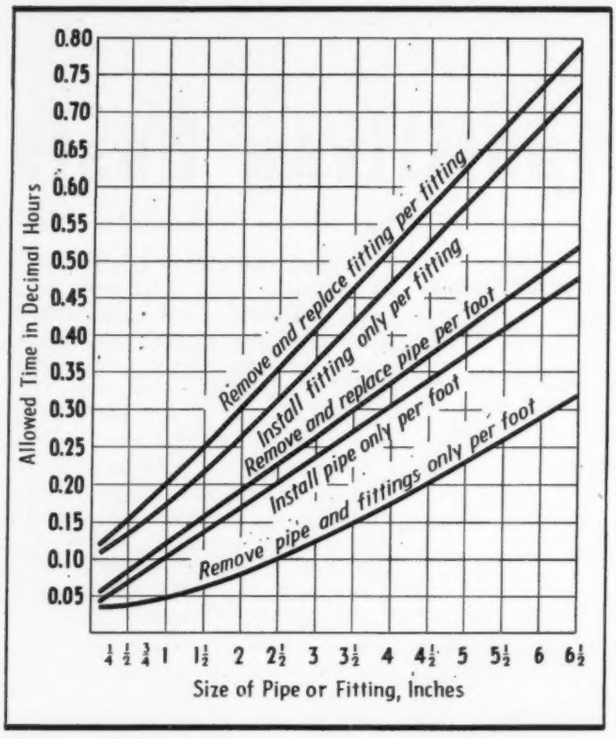


Figure 1. Time allowances on operations performed when installing or repairing pipe lines in a ditch or at floor level

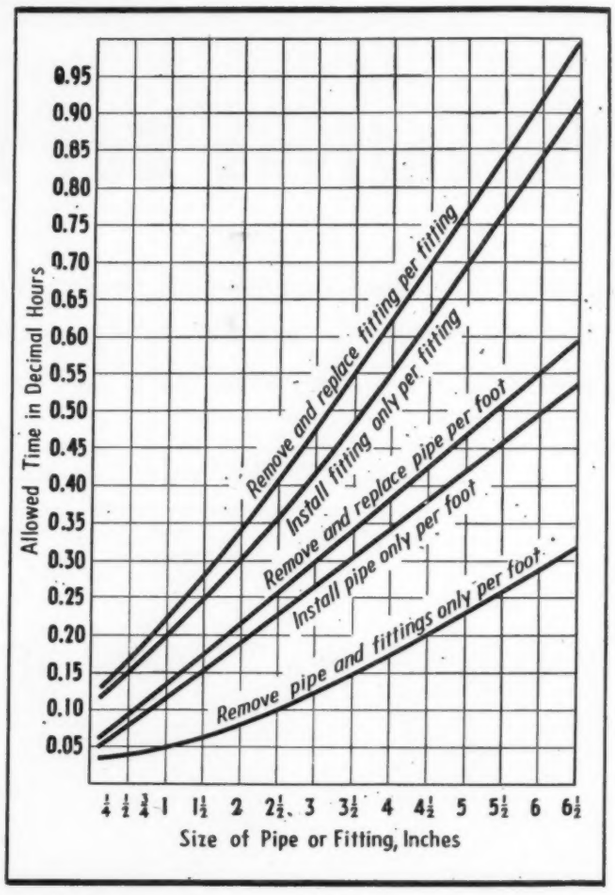


Figure 2. Time allowances for installing, removing, replacing pipe when installing or repairing pipe lines overhead

bends, and size of bends as to ratio and offset dimensions.

Studies were likewise made of the operations involved in the removal of old pipes and fittings.

In all such studies safety had to be given proper consideration, particularly on steam and other high-pressure lines. The provision of proper scaffolding for overhead work had also to be taken into account. Working conditions were found to have a decided effect on the time required to perform various operations.

After all the data had been compiled, curves were drawn as shown in Figures 1 and 2, to simplify the computation and application of time values.

In applying incentives to pipefitting the following routine for handling the work was adopted: When a group leader receives an order to perform some work, he reviews the job in detail with the time-study man. The latter then sets the standard times from his charts and tables.

Sometimes unusual conditions are encountered that are not covered by the charts. Here the time-study man must exercise judgment, based on his familiarity with the work.

To all time computed from the charts, allowances are added to cover the set-up time for collecting tools, equipment, and material, and moving to the job, as well as the amount of time required by the group leader for supervision and timekeeping. The set-up time is largely an estimate for each job because of the wide variations in the amount of work involved, distance to the job, and the kind of equipment and material required. The allowance for supervision and timekeeping is based upon a flat percentage, depending upon the nature of the supervision and the number of men a group leader can handle effectively.

If during the course of the work any changes or difficulties are encountered that were not considered in the first review, the time-study man goes over the job again with the group leader and makes due allowances.

All the men working on each job pool their earnings together on a job or contract basis. The group leader usually supervises from 12 to 15 and charges his time to each job in proportion to the time allowance previously mentioned. Under these conditions he can shift his men from one job to another as required. The men, on the other hand, receive earnings consistent with their performance.

It is particularly interesting to note that the men working under this system attempt to arrange their work so that they will have a minimum of lost time in changing from one job to another. Under the daywork system there was no incentive to get the work done efficiently. Now the men inform the group leader when they expect to complete a job so that he can have their next one laid out for them.

AVAILABLE SOON

1940 Index to

FACTORY

SENT FREE ON REQUEST

•

Address the Editor

We Check Electronic Controls Daily

That's how 25 phototube control units are kept working with the minimum of trouble. Secret is to keep parts clean, particularly lenses, and detect defects at once

EDWARD W. LOVE and JULIAN DIETER

Production Manager and Foreman, Unit Mechanics
Bristol-Myers Company, Hillside, N. J.

More than ten years' experience with a wide variety of phototube applications has taught us a good many things about the maintenance attention that they need. Equally important, it has taught us when to leave them alone.

At present we have 25 units in service. One of our first applications of electronic control was on the Ipana toothpaste machines, where it is used to insure proper positioning of the tubes prior to the filling and folding operations. Previously the tubes were positioned by hand. As the conveyor of the machine moves from left to right it is loaded by an automatic device with tubes facing in random directions. Motion of the conveyor is intermittent and at each forward movement four tubes are placed in position facing a battery of four photo-tubes.

Phototubes Say When

A rotating shaft enters the open, or bottom, end of each tube, and turns it until a spot of light from the light source of the corresponding phototube falls upon a narrow yellow line at the base of the tube. In this position a greater amount of light reaches the phototube because of the difference in the reflectance of yellow as compared with black.

The increased amount of light causes a current to flow in the phototube. This minute current is amplified and the resultant signal is applied to the grid of a thyratron tube, through which a relatively heavy current then flows. It is sufficient to operate a solenoid, which in turn throws out a clutch on the rotating shaft and thus stops the tube in the proper position.

The shafts are then lifted automatically out of the tubes, which continue on their way to the filling and folding stations.

When this installation was originally made some difficulty was experienced in obtaining satisfactory operation until we learned where to place the light source and phototubes. At first they were placed so that the phototube was on the line of mirror reflection from the surface of the toothpaste tube. The relay would not work, however, because there was not enough differentiation between the black and yellow colors, in the amount of reflected light.

Then the phototube was placed at a point on a line perpendicular to the reflecting surface, so that use was made of the scattered reflected light. As a result there was a distinct difference in the light levels reflected by the black and yellow portions of the surface, and the relay operated satisfactorily.

In the Sal Hepatica line another electronically controlled machine wraps a package measuring $1\frac{7}{8}$x$1\frac{7}{8}$x$3\frac{1}{2}$ inches in a waxed paper wrapper at the rate of 160 a minute. The waxed paper bears a label and directions for use, covering the four sides and the top. The problem is to place the wrapper on the package in exactly the proper position each time.

The paper is fed from a reel in a continuous strip at a rate that is slightly faster than necessary, and passes between a light source and a

Ed Love cast his lot with the Bristol-Myers Company in 1932, soon after leaving Rutgers University. He started as a storeroom keeper. In January, 1936, he was promoted to the position of assistant production manager, became manager in November, 1939

Meet Julian Dieter, who is responsible for the application and functioning of all electronic controls. Here he is checking a balky panel in the electronics laboratory

phototube. Black markers are printed on the paper at regular intervals. As each marker intercepts the light beam the absence of light on the phototube causes the associated thyratron relay to operate a solenoid which retards the paper just enough so that a continuously rotating knife cuts the paper at the proper place.

Since the paper is fed forward at too fast a rate the phototube relay serves to slow it down by just the right amount. The accuracy is such that the wrapper is consistently cut off within 0.02 inch of the correct position.

Whatever troubles we have had with this application have revolved around the painstaking job of properly synchronizing the rapidly rotating knife, the fast moving paper, and the tube-controlled clutches through which the various moving parts are driven.

Checking bottles containing a white powder, to make sure that they have been properly filled, is the task that has been given to another phototube relay. Closely spaced the bottles move along a belt conveyor. A light source is placed on one side of the conveyor and a phototube directly opposite it. When the bottles are all full the light beam remains broken and nothing happens. If one of the bottles is only partly filled, however, the light beam passes through the bottle to the phototube. The increase of light on the tube then causes the thyratron tube to trip, permitting a current to pass through it. This time the current lights an incandescent lamp, to attract the attention of the operator.

This unit has been in operation continuously for almost four years, with practically no maintenance.

Another phototube relay is used on an automatic scale which weighs out the three ingredients comprising one of our pharmaceutical preparations. The dial of this scale is marked just the reverse of that of the conventional scale. The pointer is set at the desired number of pounds and as the weight of material on the platform of the scale increases the pointer moves toward the zero mark on the dial.

A phototube is placed behind a small window at the zero mark and directly in front of it there is a light source. A small flag is attached to the pointer. It covers the window when the weight on the platform reaches the amount for which the scale is set, thus cutting off the light to the phototube. When this occurs the relay operates to shut off the flow of material.

All of our installations are simple enough in essence, and involve a phototube which initiates some desirable action either when light is flashed on it or when a light beam shining on it is interrupted. The number of times a minute which these units are required to operate ranges from 180 on the Sal Hepatica machines to about 30 a minute on certain other machines.

More Times a Minute

On most of the applications an alternating-current relay gives satisfactory performance. There are, however, three installations on which we have found it desirable to use direct-current relays because they can operate more times a minute and give quicker action.

It has been our experience that phototube units such as we use can be relied upon to give excellent service with a comparatively small amount of maintenance attention, provided reasonable care is used in applying and installing them. We find that phototubes last about two years when used continuously eight hours a day. Perhaps the fact that these tubes are not exposed to any higher intensity of light than is necessary for satisfactory operation has something to do with their long life.

Thyratron tubes last about a year.

Aside from tubes, failure of other elements in phototube panels is rare indeed. With more than twenty units in service we have had to replace during the past six years only four or five potentiometers, two resistors, and about ten solenoid coils. Failure of some of these coils took the form of broken leads, due to vibration.

In time the brass gibs of solenoid coils become worn and need replacing, in order to prevent binding or sticking of the armature. Failure of the armature to seat properly will almost invariably cause a burnout.

Owing to the nature of the service,

all our phototube applications are under constant supervision. Hence, there is practically no possibility that failure of a unit to operate properly will go unnoticed.

When trouble develops on any unit the chances are that it is of mechanical rather than electrical origin. For example, faulty lubrication or some other condition which causes clutches or other parts to lag is a common cause of trouble. Why this is true can easily be seen when it is realized that in most instances a solenoid energized by a comparatively small current furnishes the mechanical power for operating clutches or other parts. The amount of power available is small and satisfactory operation can be assured only when the parts to be moved are correctly adjusted and well lubricated.

To Damp Out Vibration

When we first began to use phototube controls the panels were mounted on spring suspensions, to damp out vibration as much as possible. Experience has shown that this precaution is not necessary. Therefore, panels are now mounted directly on the frames of the wrapping and other machines. Such vibration as is present appears to have no harmful effect.

The mechanics responsible for the various production lines and machines come in a half hour earlier than the operators. This half-hour is devoted to inspecting, testing, and operating the machines in order to make sure that everything is in proper condition. Tube lenses are wiped off to remove all dust. In certain places neglect of this precaution will often lead to faulty operation. Also, dust accumulating on grid leaks and other parts forms a leakage path which may conduct sufficient current to cause trouble.

Character of the glow of thyratron tubes is noted. An experienced inspector can tell a good deal about the condition of such tubes by observing the appearance of the discharge.

All light sources are checked to make sure that the filaments are glowing. Operation of phototubes is checked by throwing a light beam on the filament, or interrupting it, as the installation may require.

In general we do not remove tubes to test them. Failure or unsatisfactory operation of a tube is immediately detected either during the inspection periods, or while the machines are operating. We keep an adequate stock of tubes on hand and when one does fail it can be quickly replaced.

At the morning inspection the breaker points of direct-current phototube panels are inspected to make sure that there is no dust or oil on them. Since most of the panels are mounted close to mechanical parts which require lubrication a certain amount of trouble is experienced from creepage of oil. A film of oil on breaker points can cause no end of trouble.

In addition to the daily inspections it is our practice to inspect and dress the breaker points on direct-current panels about every two months.

Dust or oil on the lenses of light sources or phototubes is a very common cause of erratic operation or failure. Therefore, these parts are carefully wiped off each morning.

We have found that it is highly important to maintain the proper voltage across all phototubes. Since the regular power and lighting circuits are subject to some variation in voltage we eventually installed a separate circuit, to supply a small local transformer from which only phototubes are fed.

When trouble develops on a machine it is immediately noticed and reported by one of the operators, who are always in attendance. In a moment one of the mechanics is on the job. The nature and cause of the trouble usually are apparent at once. If not, the mechanic operates the machine, perhaps at reduced speed, to see whether he can uncover any clues. Usually certain tests can be applied to determine whether the trouble lies in the machine itself or in the electronic control, which is all we are interested in here.

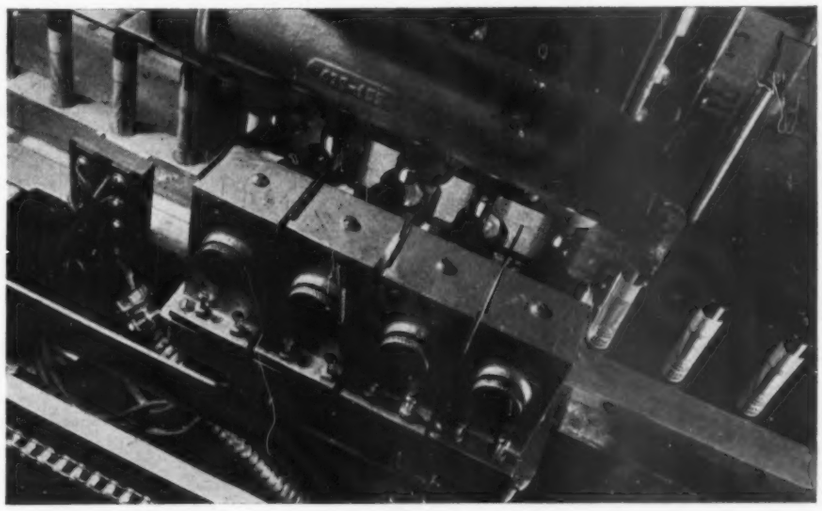
Assuming that the control is faulty, the first step is to check the light source and make sure that the lamp is burning, the lens clean, and the light beam properly focussed on the phototube. If satisfying these conditions does not restore normal operation the phototube is replaced. In the event that the new tube does not clear up the trouble the repairman inspects the thyratron tube. He may replace it even though it seems to be in good condition, judging from the appearance of the glow.

If there is still failure to operate the breaker points are inspected and cleaned or dressed if necessary. Following this, the solenoid is checked for an open circuit. Then all wiring is checked. When these measures fail to remedy the trouble, the panel is replaced by a spare unit and taken to the electronic laboratory for a complete check and overhauling.

This procedure may seem to be rather involved, but in reality all of the steps mentioned can be carried out in a very few minutes.

Our phototube controls give us little trouble. This fact must be ascribed in large part to their good design and construction. Doubtless the daily care given to them is another important factor. Installation in a clean and dry place (our production department is air conditioned) also helps to keep them in good condition.

Whatever the reasons for their good service they are practically indispensable to the efficient operation of our production department, because we have applied them only where they can perform the desired function better than any other means.



These four phototube units control revolving shafts that turn empty toothpaste tubes to the proper position as the conveyor carries them to filling and folding stations

MAINTENANCE FORMS

4. Keeping Track of Equipment

PURCHASED FROM			DATE	1A
PURCHASE PRICE		FREIGHT	ERECTION COST	
MFG. NAME		TOTAL COST		
CONDITION AT PURCHASE, AGE, ETC.				
H. P.	VOLTS	AMPS.	PHASE	
TYPE	TYPE SYMBOL		MAKE	
FRAME NO.	SERIAL NO		STYLE NO	
PURCHASED		COST	USED	
REMARKS				
DEPT			NO	
LOCATION		DESCRIPTION	CGW EQUIP NO	

PURCHASED FROM				DATE	1B
PURCHASE PRICE		FREIGHT		ERECTION COST	
MFG. NAME			TOTAL COST		
CONDITION AT PURCHASE, AGE, ETC.					
H. P.	R. P. M.		MAKE		
TYPE	VOLTS	AMPS. USED	PHASE	CYCLES	
STYLE; OPEN		FRAME NO.		STYLE NO.	
VAPOR PROOF		SERIAL NO.		MODEL	
EXP PROOF		C° RISE		FORM	
SHAFT DIA	KEYWAY		DRIVE PULLEY		
BEARING NO. (PULLEY END.)	MAKE		BEARING NO.	MAKE	
PINION	NO. TEETH		PITCH	FACE	
DEPT.			NO.	DIA.	
LOCATION		DESCRIPTION		CGW EQUIP. NO.	

Ordering jobs and recording time and materials used is one phase of maintenance paper work. Another is keeping equipment records which guide equipment selections

1. Corning Glass Works. Slightly different forms for motors and starters are used—*1A* is for starters, *1B* for motors. Both forms have space for repair data (date, description, order number, cost) on back. Still a third and simpler form is used for recording other and simpler form is used for other equipment

2. Hiram Walker & Sons, Inc. Every piece of equipment has an inventory number and equipment record card. All major repairs are noted on reverse side, with date and cost. Cards are cross-indexed with loose leaf logbook so that it is possible to learn whether a spare is available in event of breakdown

2

EQUIPMENT RECORD

No.	Name		Size
Maker		Address	
Ordered	Received	Installed	
Length	Width	Height	Weight
Speed	Production Capacity		Drawing No.
Remarks:			Parts Catalog File No.
Location			

MOTOR DATA

Open Type ☐ Vapor Proof ☐ Explosion Proof ☐

H. P.	R. P. M.	Maker		
Frame No.	Serial No.		Style No.	
Type	Volts	Amps	Phase	Cycles
°C Rise	Dia. Shaft	Keyway	Drive Pulley	
Pinion	No. Teeth	Pitch	Face	Dia.
Remarks:				

STARTER DATA

Open Type ☐ Vapor Proof ☐ Explosion Proof ☐

Type	Type Symbol	Maker		
Frame No.	Serial No.		Style No.	
H. P.	Volts	Amps.	Phase	Cycles
Kind of Fuse	Catalog No. Fuse	Amp. Fuse	Oil Switch	
Remarks:				

STEEL AND TUBES, INCORPORATED
CLEVELAND PLANT

DETAIL PLANT EQUIPMENT RECORD

3A

INDEX NUMBER

DEPARTMENT	SUB-DEPARTMENT	BLD'G NO.	SKETCH NO.	LOCATION NO.	ACCOUNT NO.
1					
2					
3					

ITEM	MAKERS NO.	OUR NUMBER

SIZE	PURCHASED FROM	MAKER

ORIGINAL DISTRIBUTION OF COST

VOUCHER NO.	DATE	APPROP. NO.	ORDER NO.	ACCOUNT CHARGED	DISPOSAL DATA YEAR	DISPOSAL DATA ACTUAL LIFE

ORIGINAL COST DATA			REPRODUCTIVE APPRAISAL DATA					
DESCRIPTION	EXPENSE	CAPITAL	DATE	APPRAISAL REFERENCE	DOLLAR VALUE	REPRODUCTIVE VALUE	ACCRUED DEP. %	SOUND VALUE
FOUNDATIONS								
INVOICE PRICE								
INSTALLATION								
MF'G COST								
CALCULATED COST								
TOTAL								

DEPRECIATION DATA FOR ACCOUNTING PURPOSES

ACCRUED DEPRECIATION DATE	%	AMOUNT	ACCRUED DEPRECIATION DATE	%	AMOUNT						
						YEAR					
						CLASS					
						RATE					

REMARKS	VALUE ON LAST DAY OF FISCAL YEAR DATE	TOTAL	EXPENSE	CAPITAL	CHANGES

3. Steel and Tubes Division, Republic Steel Corporation. In the general accounting office a record for each piece of equipment is kept on form *3A*. Space for recording rate and amount of depreciation each year is provided on the back. In the cost accounting department a file and record card *3B* is kept for each item, to show location and repair record

3B

STEEL AND TUBES, INC.
EQUIPMENT RECORD

SHOP NO 3612

DESCRIPTION

MAKER'S NAME SERIAL NO.

DRIVE

IN DEPT	REMARKS	DATE	ORDER	LAST CHECKED DATE	LAST CHECKED BY

MOTOR MAINTENANCE REPORT

4A

SERIAL MACH. NO. SECTION

TYPE FR HP VOLTS CY PH RPM

TEMP. RTG. F. L. AMPS RELAY AMPS FUSE NEW MOTOR ☐

NAME OF MACH.

TYPE OF DRIVE

DESC. OF STARTER

TROUBLE FOUND

Signed Date

(see other side)

MOTOR SERVICE RECORD

4B

SERIAL

TYPE FRAME HP VOLTS CY PH RPM

RATING SPECIAL FEATURES

INSTALLATION

CAPACITY O. L. UNIT DEPT. SECTION

PLACED IN SERVICE REMOVED FROM SERVICE

REMARKS

4. Wagner Electric Corporation. Motor repairs and service and changes of location, reported to plant engineer's office on motor maintenance report *4A*, are recorded on motor service record card *4B*. Back of form *4A* has detailed instructions to maintenance men on how to use the form

Diesels Give Us Power and Heat

Four engines with a combined rating of 670 kilowatts provide all electrical energy needed for about 1 cent a kilowatt-hour, plus hot water used for plant heating

FRITZ JENSEN
Superintendent, Rockford Screw Products Company
Rockford, Ill.

OUR PLANT purchased public service power during the first few years of its existence, paying 2.33 cents per kilowatt-hour. Eight years ago we began to make our own power with a three-cylinder diesel engine and 135-kw. 440-volt, three-phase generator. Our motors operate at 440 volts, which is stepped down to 220 and 110 volts for the lighting system and heat-treating furnaces.

Before this move was made we investigated costs pretty thoroughly. Figuring in all possible charges, we felt certain that we could make a substantial saving in the cost of power. Including 6 percent interest on the investment, a rate of depreciation that will charge off the original cost in 15 years, fuel, lubricants, labor, repairs, and maintenance, we finished the first two years with a cost for power of 1.2 cents per kilowatt-hour. Then we moved to our new plant, taking the old diesel along, and to meet the power needs of our growing volume of production we purchased a duplicate engine.

Added Two Diesels

Since then, as our power requirements have increased, we have added two more diesels. These are larger, four-cylinder units, each rated at 200 kilowatts. When our plant is running at full capacity the four diesels can just about carry the load. We are now making our power at a cost slightly under 1 cent per kilowatt-hour. This figure includes all costs, as outlined in the paragraph above. If we were leaving anything out, the omission would doubtless have been called to our attention long ago by people who wish to provide us with other sources of power.

In the eight years during which we have been generating our power with diesels, we have not had to make any major repairs. We do, however, give each engine a general overhauling every nine months. When overhauling, we take off the cylinder heads and pull the pistons. We take off the rings and clean them, put in a new top ring on each cylinder, move the other rings down one position, and discard the bottom ring. Piston-pin needle bearings are cleaned; crankpin bearings are examined. The crankcase and air passages are flushed and cleaned, and the crankshaft is checked for distortion.

Annual Maintenance, $350

Maintenance expense on our engines last year was typical. It totaled approximately $350, or just over 50 cents per kilowatt of rated capacity.

Besides our power, we have been obtaining a large proportion of our heating requirements as a byproduct of the diesel installation. The exhaust from the oldest 135-kw. engine is sent through a heat-reclaiming boiler, and the cooling water systems of all four engines are hooked together into the same system. The resultant hot water is circulated through the plant by two 3-hp. centrifugal pumps to feed 14 unit heaters. The water operates this heating system at about 130 degrees Fahrenheit, which is adequate to maintain a comfortable working temperature in ordinary weather throughout our three acres of floor space in single-story buildings with insulated roofs.

In summer the water passes through these same heaters and is cooled by the same fans. But, instead of blowing the heated air into the buildings, the fans discharge it through louvers in the roof. Thus the heaters perform a double purpose—heating in the winter and clearing the building of hot, stale air in the summer—besides cooling the water from the diesel systems all the year around.

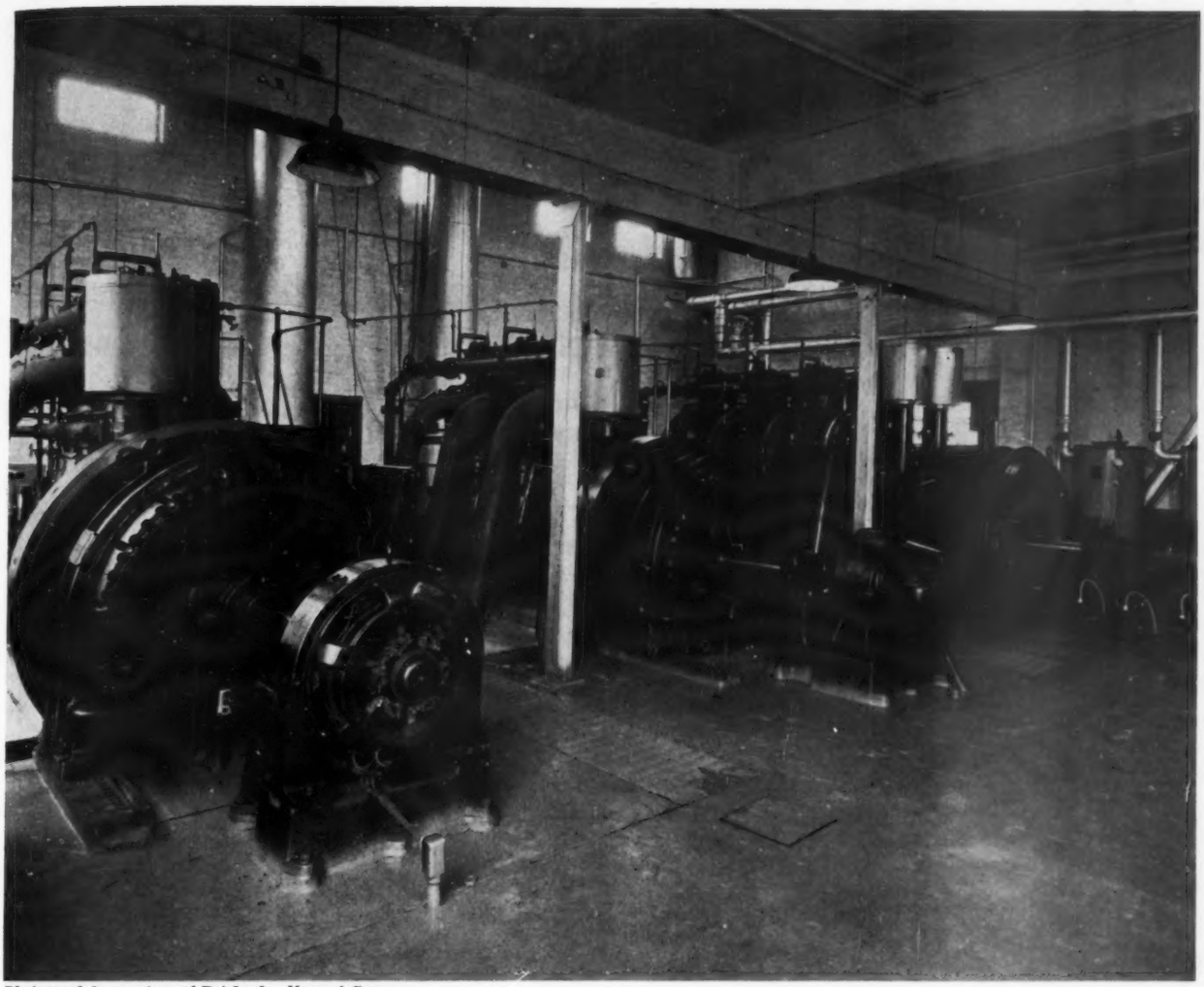
To provide for heating requirements in really bitter cold weather—we get a good many sub-zero days almost every winter, and every once in a while a drop to as low as —30 degrees—we have an auxiliary heating system which is hooked directly into the heat reclamation system. After leaving the diesel cooling systems and exhaust reclamation boilers, the water passes through three oil-fired heating boilers. When the weather makes the temperature inside the plant drop below 66 degrees Fahrenheit, these heaters start up and give the water a boost in temperature as it passes through on its way to the unit heaters. A water temperature of 150 degrees Fahrenheit will give us sufficient heat on even the coldest day.

The office is heated separately by a gas-fired furnace that burns city gas. This practice was adopted because it is important to maintain in the office a uniform temperature that is higher than in the plant. Also, the office must be warmed on holidays and weekends when the plant diesels are shut down. Hence the individual heating system for this section of the plant.

More Changes Coming

Another auxiliary heating system is centered on an oil-burning boiler in the plating department. This boiler produces steam which is used to heat the plating baths, a degreaser, and the plated work dryers.

We are in process of shifting over our equipment to do away with the use of the process-steam oil burner and to reduce by at least half the use of the oil-burning booster heaters for factory heating. Each diesel engine is being equipped with its individual exhaust



Photograph by courtesy of Fairbanks, Morse & Company

So successful was the first diesel in cutting power costs, that three other engines were added as power requirements increased

heat reclamation boiler. Incidentally, the boiler serves as a silencer; since the cost of a silencer is identical with the cost of the boiler, the reclaimed heat is net profit.

All these boilers are being interconnected with one main heater, which also ties into the present cooling water circulating system. The water will continue to circulate through the oil-burning booster heaters, and from there will go on to supply room heat as always through the unit heaters. The heat thus reclaimed will also supply the plating baths, plating dryers, and degreaser. The oil-burning unit now in the plating room is about to be removed—which means, as must be apparent, complete elimination of the present costs of making process steam. Because of the added input of heat units into the factory-heating water, we expect that the use of the booster boilers will be reduced by at least 50 percent. In fact we should not be surprised to find the byproduct heating system adequate for any weather that does not bring a temperature of —10 degrees Fahrenheit and a high wind.

Just to Play Safe

A sizable addition to our plant is being erected at the front end farthest from the power plant. Just to play safe on heating this addition, we plan to set up the oil burner from the plating department as a booster unit in the new building. It may be that we shall be able to get along without it; but we had rather make up our minds on this point after the byproduct heating installation has proved itself on a day when the mercury is trying to get out through the bottom of the thermometer.

In a recent year we produced a little more than 1,000,000 kilowatt-hours at a cost for fuel and lubricating oil of 0.55 cents per kilowatt. The over-all cost, including every possible expense attributable to this account, was slightly less than 1 cent per kilowatt. In this same year a total of $1,065 worth of fuel oil was used for producing process steam and for boosting the heating water in cold weather. By a conservative estimate the new byproduct heat installation should save during this winter $240 worth of oil formerly used to produce process steam and $412 worth of oil used to boost plant-heating water temperature. The saving totals 61 percent of these items previously expended. And it is expected that the oil which will be burned to help in heating the new addition will be more than matched by the value of the heat delivered there by the byproduct heat system.

When You Install Limit Switches

Make sure particularly on stationary electric hoists, that they have been properly selected and placed where they are accessible and can operate most dependably

GILBERT LINDGREN
Electrical Maintenance Foreman
Hudson Valley Fuel Corporation
Troy, N. Y.

LIMIT SWITCHES of some kind are used on almost every type of electric hoist. Here their application will be discussed with particular reference to stationary electric hoists, although the fundamental principles which govern their use are applicable to most machines, as well as to hoists and conveyors.

With limit switches, as with most other types of apparatus, no one design has proved to be a cure-all. Local conditions govern to a large degree the type, location, and method of applying.

Limit switches are used for two general classes of service. In the first class the switch is used for the purpose of controlling or determining the limits of normal operation of a machine. The second class includes switches used as an emergency stop or overtravel device, which operates only in the event of failure of the normal limit control.

The primary purpose of an emergency stop limit is to protect a piece of equipment if the normal limit control fails. For this reason it is advisable to have these two classes of service in separate units, both mechanically and electrically. Oftentimes the two are combined into one unit and it may work out satisfactorily for a long time if an operator is in constant attendance. On full automatic hoists, however, where complete dependence must be placed on the limit switches, the two classes of service should be kept separate.

Figure 2 shows a control limit switch connected to a fully automatic hoist. A simple limit switch takes care of overtravel in the up direction, while down overtravel is stopped by a slack cable switch similar to the one shown in Figure 1. Every cable-operated hoist should be provided with a slack cable limit of some kind. This type of emergency stop is one of the most effective in case a bucket hangs or fouls in the runway.

The emergency circuit is superimposed rather than separate, so that it opens the normal control circuit. This arrangement will often stop a machine when contactors are held in because of an accidental ground. A ground may occur on an emergency circuit as well, of course, but the objective is to eliminate every possible chance of an electrical failure or fault.

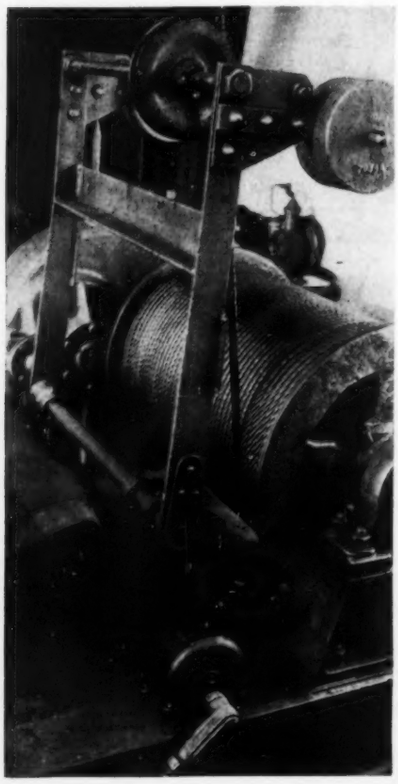


Figure 1. A slack cable switch stops the hoist when the bucket hits bottom, or if it gets fouled in the runway

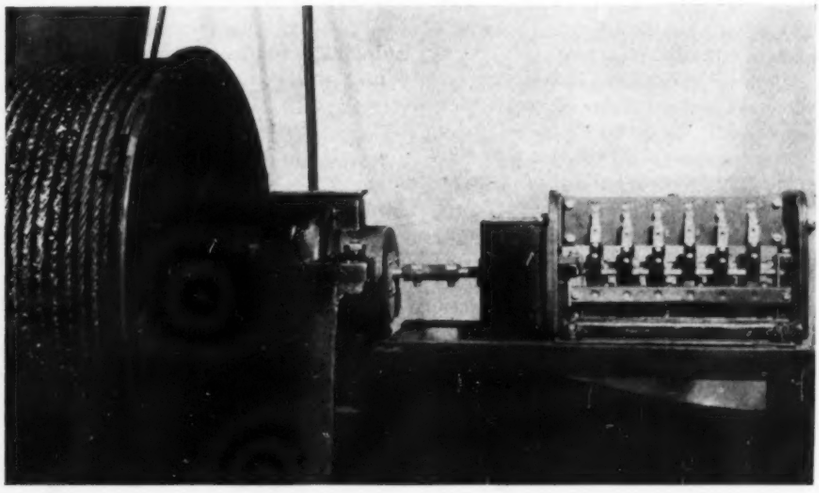


Figure 2. This limit switch protects an automatic hoist against overtravel upward

Figure 3 shows a control circuit that is maintained by an undervoltage contactor. All emergency circuits are in series with this contactor. The reset button may be locked open so that only an authorized person may reset it, after it has been opened. Emergency limits that cut off the main power supply may be used to good advantage in some instances, but it is usually advisable to open only a control circuit and leave the job of breaking heavy current loads to a contactor or circuit breaker, which is designed for such service.

It should be noted that the above statement is made with particular reference to alternating-current hoists.

With control limit switches, accessibility is a highly important factor in the matter of location. It is well known that the amount of routine inspection a piece of apparatus will receive is in proportion to its accessibility. The more routine inspection a limit switch receives, the less trouble will it give.

The location of an emergency stop

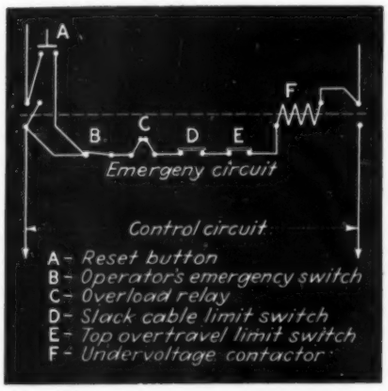


Figure 3. Here an undervoltage contactor, in series, maintains the control circuit

switch is a little different. Here the "point of hazard" should determine the location. That is more important than accessibility. For example, a limit switch installed to prevent the hoisting bucket from overtraveling and striking a beam should be located on or as near as possible to the beam, and should be operated or tripped by some part of the bucket. If the hazard involves the bail of the bucket striking the cable sheave, the bail should operate the limit switch.

This point cannot be emphasized too strongly. One often sees emergency stops located in a handy place by running a cable or series of levers from the point of danger to the limit switch itself. No limit switch is more positive in operation than the connecting mechanism. Therefore make the action as direct as possible.

MAINTENANCE SERVICES

NOW AVAILABLE

How Maintenance Can Aid The National Production

A check chart designed to help you get the most out of your plant and equipment. Published as a regular part of December, 1940, FACTORY

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ALSO AVAILABLE

YOUR PLANT AND THE NATIONAL PRODUCTION

Published in November. To help you test your plant's preparedness

Either check chart, 10 cents per copy

The fact that emergency limits are very often located in out-of-the-way places, puts them in a class with the night watchman. They are seldom noticed until suddenly called upon to act; then they either do a good job and prevent an accident, or fail and permit a major breakdown to occur. For this reason it is well to check up on the inspection of limit switches. They are very easily forgotten.

Design Must Be Simple

The duty of making adjustments and repairs to very complicated limit switches and controls is usually assigned to some one man. Where continuous day-and-night operation is important, adjustments or repairs may be required at any moment. For this reason it is advisable that limit devices be as simple in design and mechanical operation as possible, so that the regular maintenance man can make necessary adjustments or repairs. An hour's delay caused by waiting for some particular person to make an adjustment to a complicated device, is just as inconvenient to the production department as a delay from any other cause.

Avoid the use of those devices that maintenance men are afraid of, because of their complexity. So far as the maintenance man is concerned, every moving part on any device is an added potential failure hazard.

Whenever possible avoid the use of brackets attached to moving parts: They may be left off during repairs, be bent out of shape, or become loosened. Have the brackets attached to the limit switch itself, where they will receive more attention from the maintenance man.

Give emergency switches just as much attention as is given to the control switches. They are even more important.

Avoid the use of chains, counterweights operated by small cables, or monkey motion levers. The fewer levers, and moving parts there are, the smaller the chances of failure.

Janitors on Schedule Keep Plant

It is the best way to make sure the work of 150 men is properly directed and that all plant equipment is cleaned at the intervals which experience has shown are desirable

C. C. WILLIAMS
Plant Engineer, Plymouth Division
Chrysler Corporation
Detroit

KEEPING our half-mile-long plant in shipshape condition requires the services of about 150 men in all shifts and careful planning of their activities. In general, the work is divided into two categories: (1) Cleaning that is done according to a definite schedule; (2) work that is more or less routine in the sense that it is done by men assigned to certain areas of the plant with general responsibility for maintaining those areas according to the accepted standards.

The purpose of janitor services is to prevent interruption to production. The fact that production has never been interrupted in our plant by fires is some indication of the efficacy of this service, despite the annual use of a million gallons of gasoline and somewhat more of oils and greases.

In an automobile assembly plant the spray booths and enamel ovens, as well as the duct systems, stack, pits, and trenches necessary to their operation, must be cleaned periodically to insure proper operation and prevent accumulations that would result in fire hazards. Below is shown the form used by the janitor foreman to schedule the cleaning of each such piece of equipment in every department of the plant. How often equipment is cleaned depends, of course, upon its functions and operation, but the frequency that experience has indicated as necessary is rigidly adhered to.

Spray booths in general are cleaned thoroughly once each week, although some are cleaned three times a week. Spray booth tanks are cleaned every two weeks. A portion of the lapping oil system in the cylinder block machining department is cleaned every week, and the remainder at the nearest week end when 70,000 blocks have been machined.

A Schedule Each Month

The janitor foreman makes out his schedule at the beginning of the month by listing equipment to be cleaned in each department. To this list are added special requests from production superintendents. Instructions are written daily for each shift foreman.

At this point the cooperation of the fire marshal in the plant protection department comes into play. A copy of the cleaning instructions, taken from the booth cleaning record, which is issued by the janitor foreman to the shift foreman, goes to the fire marshal of the shift in which the cleaning will be done. He must inspect each piece of equipment cleaned and indicate his approval on the janitor foreman's copy of the cleaning instructions. A fire marshal's inspection follows every scheduled cleaning.

This cooperation is a matter of good organization practice. If the inspection were to be made by the same group that did the cleaning, there would be a natural tendency to let friendships cover shortcomings.

The representative of the insurance company, on his periodic rounds, checks the fire marshal's cleaning report and also that of the head janitor, of which it is a duplicate. The head fire marshal may believe that some pieces of apparatus are not cleaned often enough. In this event he, together with the plant engineer and the janitor foreman, may decide to increase the frequency of the schedule.

It should be realized, of course, that the fire marshal and the janitor foreman are in constant contact; if any situation or condition is considered to constitute a hazard, it is called to the attention of the janitor foreman.

In addition to the scheduled cleaning of equipment connected with the handling of hazardous liquids, aisles are

BOOTH CLEANING RECORD MONTH_____ _____19___

Name	No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Bearing Cap	1	B S							B							B S							B							B S		
Cylinder Block	2																															
Cylinder Head	3																															
Chassis Line #1	4																															
Chassis Line Stack	1-2																															
Chassis Line Oven																																
Chassis Line #2	5																															
Chassis Line Stack	3-4																															
Chassis Line Oven	4-5																															
Block Test Pits																																
N & S Body Feed Lines																																

At the beginning of each month the janitor foreman makes out month's cleaning schedule, listing equipment to be cleaned each day

Cleaner

Floor cleaning machines increase efficiency and effectiveness of the janitor force, and help it to maintain the high standards of cleanliness which are required of it

mopped at regular intervals. Duck boards along assembly conveyors and in the machine shops are lifted each week so that the floor may be scrubbed and washed clean.

Enamel tanks and storage tanks for oils and greases are cleaned yearly of the several inches of sludge which accumulates during that time. This cleaning, while it may be thought of as being on a schedule, is always done at the model change-over period.

When Tanks Are Cleaned

We have ten tanks ranging from 5,000- to 15,000-gal. capacity. Some of these tanks are 8 feet in diameter and 20 feet in length. When installed these large tanks are provided with a high manhole and a low one. When they are to be cleaned, the safety engineer and the fire marshal are notified. These two functions are concerned because the safety of personnel is involved. Because of the care and cooperation exercised in this part of the work, no accidents have ever occurred while tanks were being cleaned. No formal signature of approval is required, but a fire marshal is in constant attendance with the necessary firefighting apparatus while the cleaning is going on.

A portable blower forces air through the tank, from which the manhole covers have been removed, for about 8 hours before the cleaning begins. This air blast is kept going when needed during the cleaning process. The man who goes into the tank wears an air mask, rubber boots, and rubber gloves. Two other men are in constant attendance. A shovel, mop, hot water, and cleaning compound are used on the large tanks.

For cleaning tanks under 5,000-gal. capacity, we use a steam hose operated from the outside, after all sludge that will drain off has been allowed to flow through the manhole.

Window cleaning is no small item; about 625,000 square feet of glass, both inside and outside, is involved. It is cleaned on just as definite a schedule as is a paint spray booth. For several reasons, however, this cleaning is done by an outside contractor. The plant is divided into 15 areas, for this purpose, and the number of square feet of glass in each area is recorded in the plant engineer's office. Experience dictates the desirable frequency of cleaning for each area. Windows in the offices and hospital, for example, are cleaned every two months both inside and outside, whereas skylights over the machine shop are cleaned every three months, both inside and out.

The cleaning schedules obviously depend upon the standard of cleanliness insisted upon by the management. Each month a bid is secured for the area scheduled to be cleaned during that month and the contractor does the work, subject to the inspection of the plant engineering department.

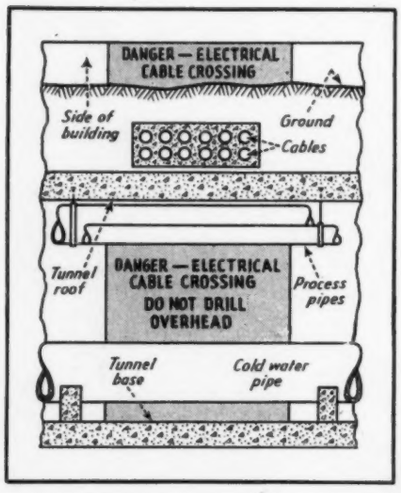
We have been talking about special equipment such as spray booths and tanks, and such areas as aisleways and window areas, all of which are cleaned according to a rigid schedule. These items do not of course cover all the cleaning that our janitor force must do. For example, large areas in departments such as production and receiving have not been mentioned.

Care of these departments is handled by assigning janitors to definite areas in the plant in order to place responsibility on the individual and build up pride in workmanship. Moreover, it is found that better cooperation with the production organization results when a janitor is working continuously within the same area. Perhaps the fact that the cost of cleaning is charged to building maintenance, and not to productive departments, helps. Certainly it permits the development of a uniform standard and a spirit of pride in the janitor force—both of which are highly desirable.

Maintenance Service Shorts

Readers are invited to contribute brief illustrated articles reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

BUILDINGS, SERVICES, MAINTENANCE



Cable Crossing Warnings Stop Cable Damage

K. N. Banthin, *Oak Park, Ill.*

In a chemical process plant all service and process pipe lines are located in a series of interconnecting tunnels. All high-voltage power feeders are located in fiber ducts incased in concrete, radiating in various directions from a central power station and in many locations crossing above the pipe tunnels.

Due to rapid advances in manufacturing methods it was necessary to employ outside contractors to install additional process piping. In investigating a power failure, it was found that a steam fitter had installed a pipe hanger in the roof of a tunnel directly under a power cable crossing. Due to the concrete spalling out in the drilling of the hole for the cinch anchors, the steamfitter had drilled an extra-deep hole which extended through the tunnel roof and into the concrete incasing the power cables. Installation of the bolt and the cinch anchors had bruised the insulation on the cable, and the power failure came about one month later.

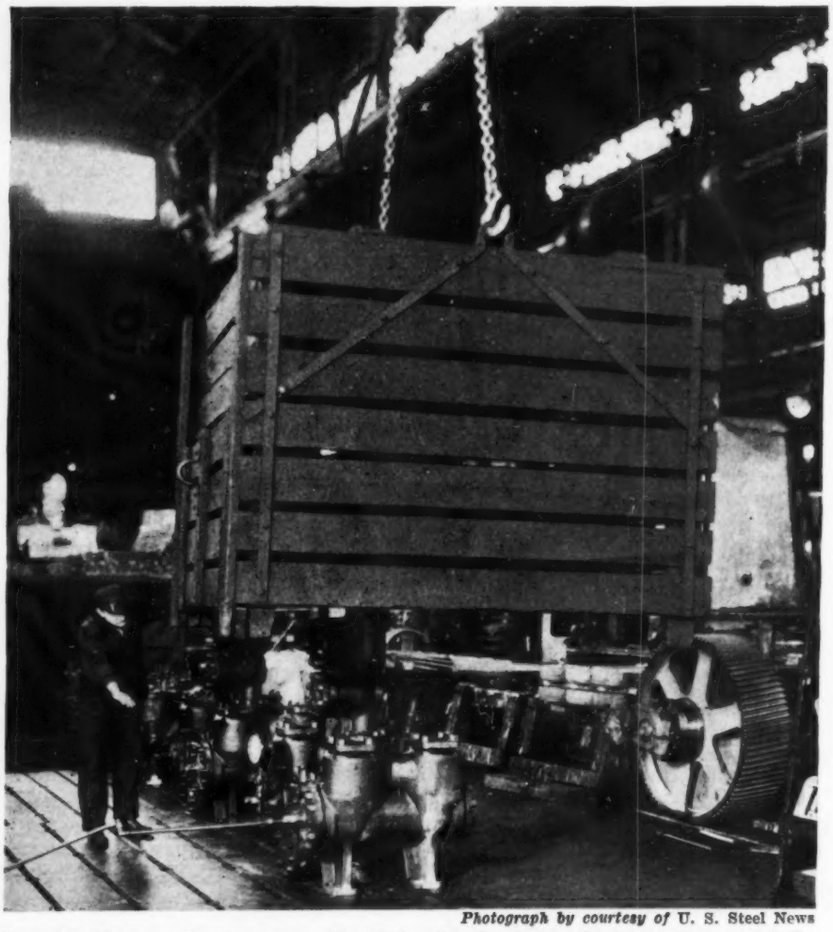
To prevent recurrence, protect workmen from possible electrocution, inform all employees of power cable crossings, and prevent shutdown of operations, the following steps were taken. On the walls of the building bright red areas about one by four feet were painted at grade elevation, directly over the power cables, with the caption "Danger—Electrical Cable Crossing" painted in white letters. In the tunnels, bright red areas about four feet wide were painted on the tunnel top and sides directly below the cable crossings, and captioned "Electrical Cable Crossing—Do Not Drill Overhead."

The cost of engineering work in locating cable crossings, preparing wall surfaces, painting, and lettering amounted to $21 per location. In the cited case, this would mean a saving of $889.

Wooden Cage Protects Pump Testers

The illustration shows the heavy wooden cage used as a safety measure in the testing department of Wilson-Snyder Manufacturing Corporation at their Braddock, Pa., plant.

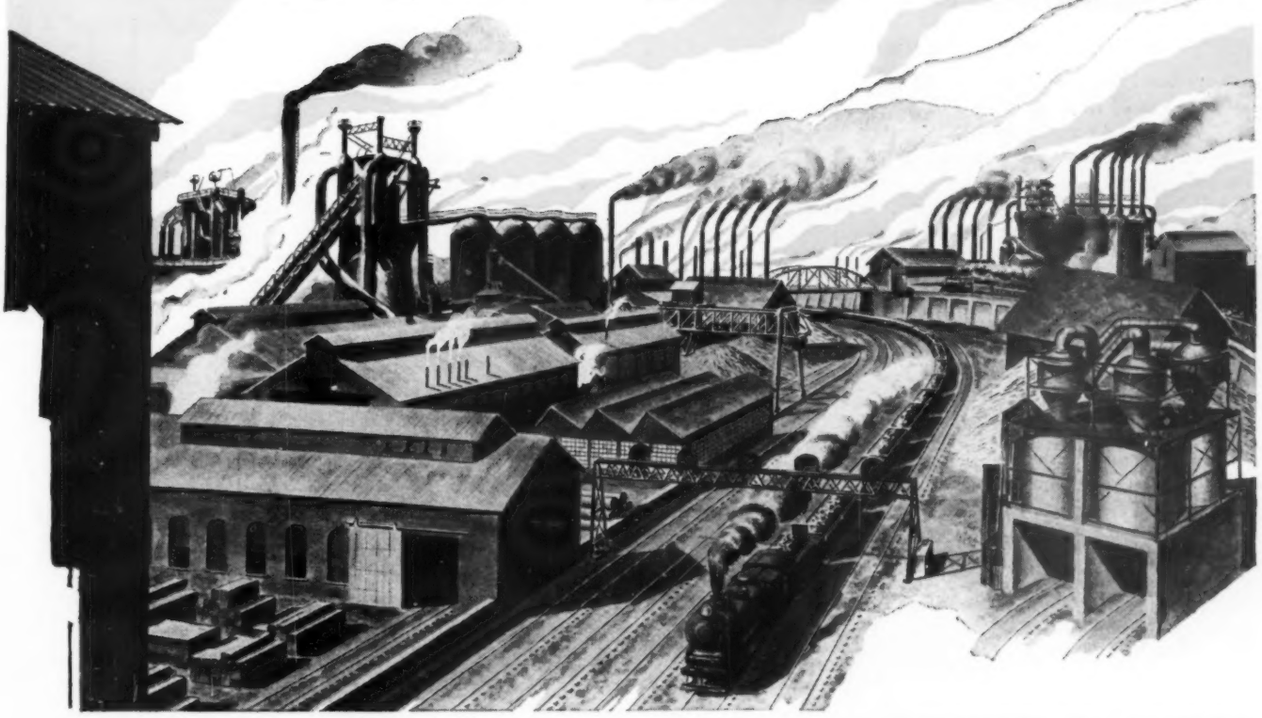
Before the pumps manufactured by this company are assembled for running tests the fluid end castings are subjected to a hydrostatic test to detect hidden defects. All types of pumps are tested, under pressures ranging from two to four times the specified working pressure. To protect the men on the test floor from possible injury in the event that the fluid chamber or any of the fittings should break, the pump



Photograph by courtesy of U. S. Steel News

Lowering "bull pen" over pump. If a fitting breaks during the test, pieces won't fly

America speeds up



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The result is faster handling of heavier loads, and a livelier truck with more pep, power and speed, and more tonnage handled per charge. There are Exide-Ironclads assembled in steel trays for every size and type of electric industrial truck.

For a further improvement in materials handling, there is the Exide System that cuts delays in the service, simplifies battery maintenance, and prolongs battery life. Write for free booklet, "The Exide System for Better Material Handling."

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IRONCLAD
BATTERIES

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

is enclosed in the cage during tests.

Known locally as the "bull pen" this cage is built of heavy hardwood planks reinforced by steel straps. As will be seen, a sliding door in front permits workmen to enter. The cage is raised and lowered by an overhead crane.

•

Rig for Drilling Holes in Ceiling Halves Time

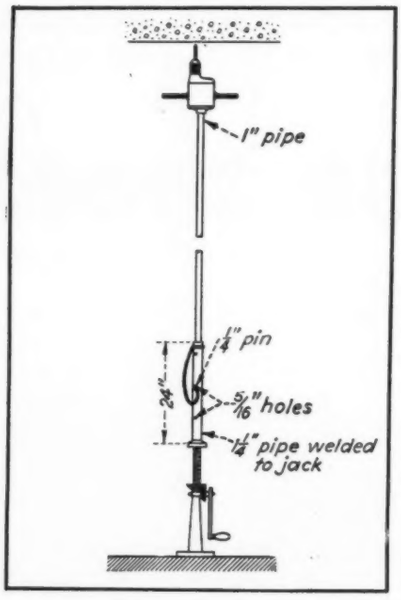
JAMES J. WENNER, *Flint, Mich.*

An electrical contractor faced with the problem of drilling a large number of ½-in. holes in a concrete ceiling for hanging electrical fixtures and conduit, devised the rig shown in the sketch. It did the job in half the usual time.

To make, obtain a screw-type automobile jack and replace the ratchet handle with a sturdy crank. To the jack nut braze a 24-in. length of 1¼-in. pipe through which five 16-in. holes have been drilled spaced on 6-in. centers.

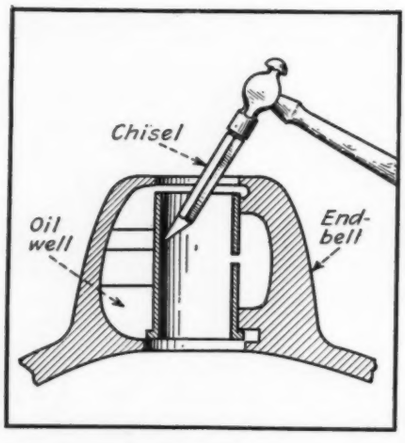
Remove the handle of a ½-in. portable electric drill and provide a means of fastening a length of 1-in. pipe. The length will depend upon the ceiling heights most commonly worked. The manner of fastening the drill to the pipe will depend upon the make of drill.

The 1-in. pipe slips into the 1¼-in. pipe as shown; thus a 24-in. adjustment can be obtained without changing the length of 1-in. pipe. The removable pin is chained to the pipe so that it won't be lost.



In use, the electrician, standing on a ladder, guides the drill while a helper turns the jack crank, forcing the drill into the concrete ceiling.

ELECTRICAL UTILIZATION



Uses Chisel to Drive Out Bearing Sleeves

H. SAUVÉ, *Temiscaming, Que, Canada*

A sharp, V-pointed chisel is a very handy tool for removing motor bearing sleeves that cannot be pounded out of the endbell, because striking the end of the sleeve might easily mushroom the end sufficiently to prevent it from sliding out as easily as it should.

As shown in the sketch, the chisel is inserted in the sleeve and held at an angle that will permit the point to dig into the babbitt, when it is struck with a hammer.

•

Laminations Corroded, Motor Failed

L. A. HUNT
Assistant Superintendent
English Electric Company of Canada
St. Catherines, Ont., Canada

Causes of motor failures are numerous, and sometimes quite unexpected. One instance in which unforeseen conditions caused trouble involved a standard open-type motor driving a brine pump in a cold room. Although the pump was 3 feet away, brine was found inside the motor. The fan had drawn it in and thrown it against the windings, which in this instance were well protected with an acid-resisting compound. The brine, however, attacked the motor laminations.

The teeth at the ends of the slots at the fan end of the motor rusted away. As the iron was eaten away the slot insulation back of the acid-resisting coating was exposed and breakdown of the winding eventually resulted.

In this application a totally enclosed motor should have been used, but further trouble was prevented by removing the fans from the motors in this cold room and treating the iron with a rust preventive.

•

Low-Voltage Transformer Finds Several Uses

NORMAN C. MULLER, *Oberlin, Ohio*

Several years ago we made a low-voltage transformer which has been found to be highly useful for thawing frozen water pipes, and for some other applications requiring a heavy current at low voltage. It was made from a damaged 5-kva. 2,300/230-volt transformer by removing the primary, leaving the 230-volt winding in place. About twenty turns of No. 2 stranded conductor were then wrapped around the core, to serve as the secondary.

Other uses to which we have put this transformer include testing circuit breakers and checking the setting of breaker relays.

With the aid of a set of suitable tongs the joints of copper water lines can easily be sweated, eliminating the risk of fire and explosion involved in the use of other ways of doing such work.

•

Uses Milling Cutters to Slot Riser Bars

ED. SWAN, *Kearney, Neb.*

When rewinding d.c. motors and generators for various conditions that make it necessary to use larger or different-shaped wire, it will be found that the riser bars will not accommodate the new conductors.

In such instances we have tried to

KEEP THEM YOUNG WITH HYATTS

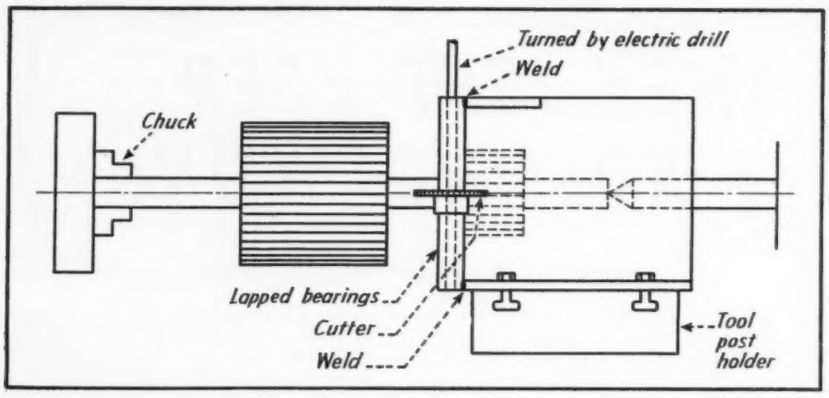
IT'S ALWAYS SMOOTH GOING for the cranes, trucks, hoists and other material handling equipment that employ Hyatt Quiet Roller Bearings. Since the early days of high speed production . . . when builders first came to us for their anti-friction bearing requirements . . . Hyatt has increasingly played a prominent role in providing that quieter, smoother, steadier performance which, today, American industry so enjoys. Hyatt Bearings Division, General Motors Sales Corp., Harrison, N. J., Chicago, Pittsburgh, Detroit and San Francisco.

CONCO ENGINEERING WORKS, Division of H. D. Conkey & Company, Mendota, Illinois, builds Hyatt Roller Bearings into these Conco Electric Low-Headroom Cranes because Hyatts help assure long life and easy operation.

HYATT

ROLLER BEARINGS

QUIET



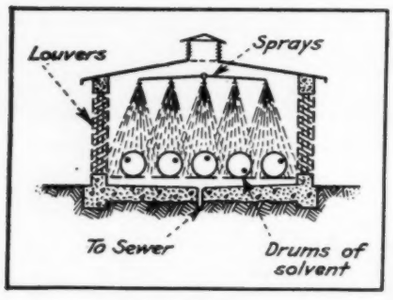
enlarge the slots in the bars by sawing, but were not very successful. Recently we built a device using milling cutters and metal slitting saws driven by an electric drill, which has been found to be very satisfactory. Details are shown in the illustration.

This fixture is mounted on a lathe. The armature is chucked in the lathe and the cutter centered in the riser bar. When the drill is started and the tool is fed forward by hand the cutter will enlarge the riser bars to the depth required. The width of the slot will be, of course, the same as the thickness of the cutter used.

It is important that the bearings fit well and that the shoulders against which the cutter and the holding nut bear be faced off true, in order to get accurate results.

With this device it took us only 35 minutes to mill out the risers in a 6-kw. generator having 72 bars.

HEAT, LIGHT, AIR CONDITIONING



Water Sprays Reduce Solvent Storage Hazards

S. H. COLEMAN, *Bethesda, Md.*

Plant storage of highly volatile solvents such as ether, acetone, and similar fluids characterized by very low boiling points must necessarily be undertaken with special care.

Liquids of this class are preferably kept out of doors, both to insure against undue concentration of vapors that may result from normal evaporation or from spillage and leakage and to localize the effects of possible fire or explosion. Most states and cities have laws or ordinances requiring outside bulk storage of dangerous volatile liquids and specifically regulate the location, type, and protective devices required for tanks used to hold these fluids.

It must be remembered, however, that volatile solvents in less than bulk lots are also hazardous unless properly taken care of. Here again outside storage is indicated. One large chemical plant handles this situation by storing drums and smaller containers in a shed which is open on all four sides to insure ventilation, and is so constructed that the direct rays of the sun cannot reach the solvent holders. To limit the temperature of the liquid during the hot summer months, a spray system is provided to keep all containers continuously wetted with cold water.

•

Heat-treating furnaces in one plant were formerly fired with gas or oil. A stoker was installed in one of these furnaces, and careful checking shows that the cost of coal firing is less than that of oil or gas.

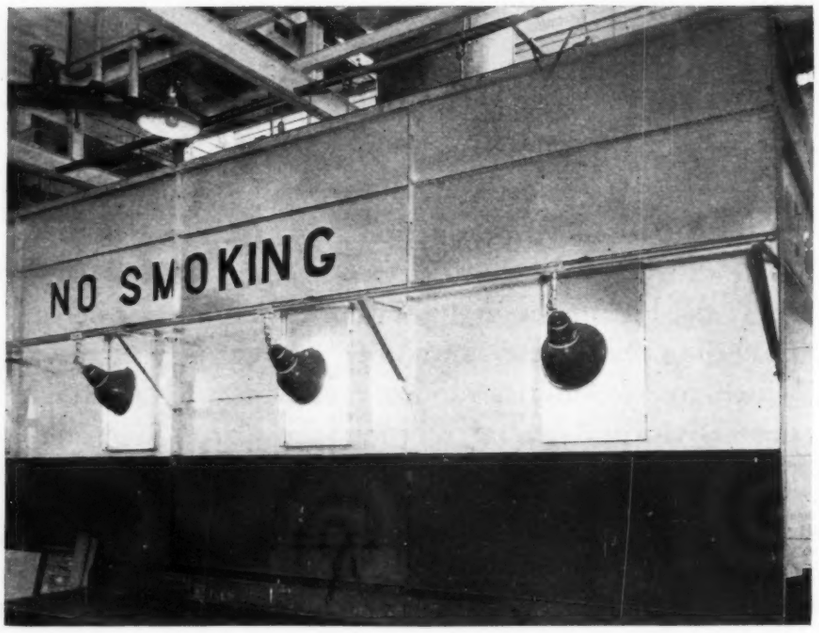
•

Outside Lighting of Booth Eliminates Hazards

H. S. KNOWLTON, *Boston*

Illumination of a large spray booth in a New England machine tool plant is provided from the outside, in order to keep the interior free from obstructions and avoid any possible danger of fire from breakage of lamps or trouble with the wiring.

This booth is 50 feet long, 12 feet wide, and 11 feet high. As the illustration shows, the interior is lighted by 200-watt lamps—there are twenty in all—in angle reflectors spaced 5 feet apart in front of 17¼x29¼-in. wired glass windows. The reflectors are mounted on 1-in. conduit which is supported by 1¼x1-in. strap-iron brackets. Ten lamps on each sidewall provide highly satisfactory illumination.



Lighting spray booth from outside leaves more free room inside, eliminates a hazard

AMAZING COMFORT AND ECONOMY IN NEW Soft-Tuff ScotTissue TOWELS

FROM the Scott laboratories has come a remarkable tissue towel, achieved by the Scott Duralose process. Called the "Soft-Tuff" ScotTissue Towel, it has kept its famous *softness,* yet is much *stronger* when saturated.

Since each towel can be used *up to saturation,* they go farther, reduce waste. In economy tests, the new "Soft-Tuff" ScotTissue Towels have materially lowered previous ScotTissue Towel consumption.

The use of the new "Soft-Tuff" ScotTissue Towels has increased approximately 40% in a few months. They have been adopted by many great industrial plants, as well as thousands of offices, throughout the world.

Let us demonstrate *to you* their unusual economy and comfort. Scott Paper Co., Chester, Pa.

Copr., 1940, Scott Paper Co. Trade Marks "ScotTissue," "Thirsty Fibre," "Duralose" Reg. U.S. Pat. Office. Trade Marks "Soft-Tuff," "Washroom Advisory Service" Registrations applied for.

Eliminate the Washroom "Double Standard"

IN THE PLANT, workers appreciate these sanitary, individual towels. Since "Soft-Tuff" ScotTissue Towels are much stronger in use, one is enough... waste is cut.

IN THE OFFICE, executives enjoy the soft, pleasant texture of these new towels. They help eliminate lint being left on the face or clothing.

The Scott Washroom Advisory Service will help you arrange washrooms comfortably, hygienically and economically. It will suggest ways to improve traffic conditions, reduce waste and increase employee and customer good will. Write for details. No obligation!

(CONTINUED FROM DECEMBER)

Electrical Control Troubles and Their Causes

J. H. HOPPER

Industrial Control Engineering Department, General Electric Company, Schenectady, N. Y.

Table I. Types of Control Troubles and Their Causes

RELAYS, D.C. TIMING

Mechanical Escapement

Sticking
(*a*) Dirt
(*b*) Worn parts
(*c*) Improper adjustment
(*d*) Corrosion
(*e*) Mechanical binding

RELAYS, MOTOR-OPERATED

Induction Disk or Cup Type

Failure to Operate Properly
(*a*) Coils connected wrongly
(*b*) Wrong coils
(*c*) Mechanical binding

Insulation Failure
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

RELAYS, MOTOR-OPERATED

Timing

Failure to Reset
(*a*) Mechanical binding
(*b*) Worn parts
(*c*) Dirt

Failure to Time Out
(*a*) Mechanical binding
(*b*) Worn parts
(*c*) Motor damaged
(*d*) No voltage on motor
(*e*) Dirt

Insulation Failure
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

Mechanical Wear
(*a*) Abrasive dust
(*b*) Improper application (in general not suited for continuous cycling)

RELAYS, THERMALLY OPERATED

Burning or Welding of Contacts and Shunts
(*a*) Shorts on control circuits with too-large protecting fuses
(*b*) Severe vibration
(*c*) Dirt
(*d*) Oxidation

Failure to Reset
(*a*) Broken mechanism
(*b*) Corrosion
(*c*) Dirt
(*d*) Worn parts
(*e*) Resetting too soon

Failure to Trip (Motor Burnout)
(*a*) Wrong-sized heater
(*b*) Mechanical binding
(*c*) Relay previously damaged by heavy current
(*d*) Dirt
(*e*) Corrosion
(*f*) Motor and relay in different ambient temperatures

Insulation Failure
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

Trips Too Low
(*a*) Wrong heater
(*b*) Relay in high ambient temperature (check motor)

RESISTORS

Breakage, Distortion, and Wear
(*a*) Overheating
(*b*) Mechanical abuse
(*c*) Severe vibration
(*d*) Shock

Corrosion
(*a*) Excess moisture
(*b*) Salt air
(*c*) Acid fumes

Insulation Failure
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

Overheating
(*a*) Used above rating
(*b*) Running on starting resistor

RHEOSTATS, MOTOR OPERATED

Insulation Failure
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Accumulation of dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

Resistor Failure
(*a*) Overcurrent
(*b*) Moisture
(*c*) Corrosive atmospheres

Wear on Segments or Shoes
(*a*) Abrasive dust
(*b*) Very heavy duty
(*c*) No lubrication

SOLENOIDS, A. C.

Broken Pole Shader
Heavy slamming caused by:
(*a*) Overvoltage
(*b*) Mechanical underload
(*c*) Wrong coil
(*d*) Low frequency

Coil Failure
(*a*) Moisture
(*b*) Overvoltage
(*c*) High ambient temperature
(*d*) Failure of magnet to seal in on pickup
(*e*) Too-rapid duty cycle
(*f*) Corrosive atmosphere
(*g*) Chattering of magnet
(*h*) Metallic dust
(*i*) Mechanical overload (cannot pick up)
(*j*) Mechanical underload (slamming, resulting in mechanical failure)

Failure to Drop Out
(*a*) Mechanical binding
(*b*) Gummy substance on magnet faces
(*c*) Airgap in magnet destroyed
(*d*) Voltage not removed

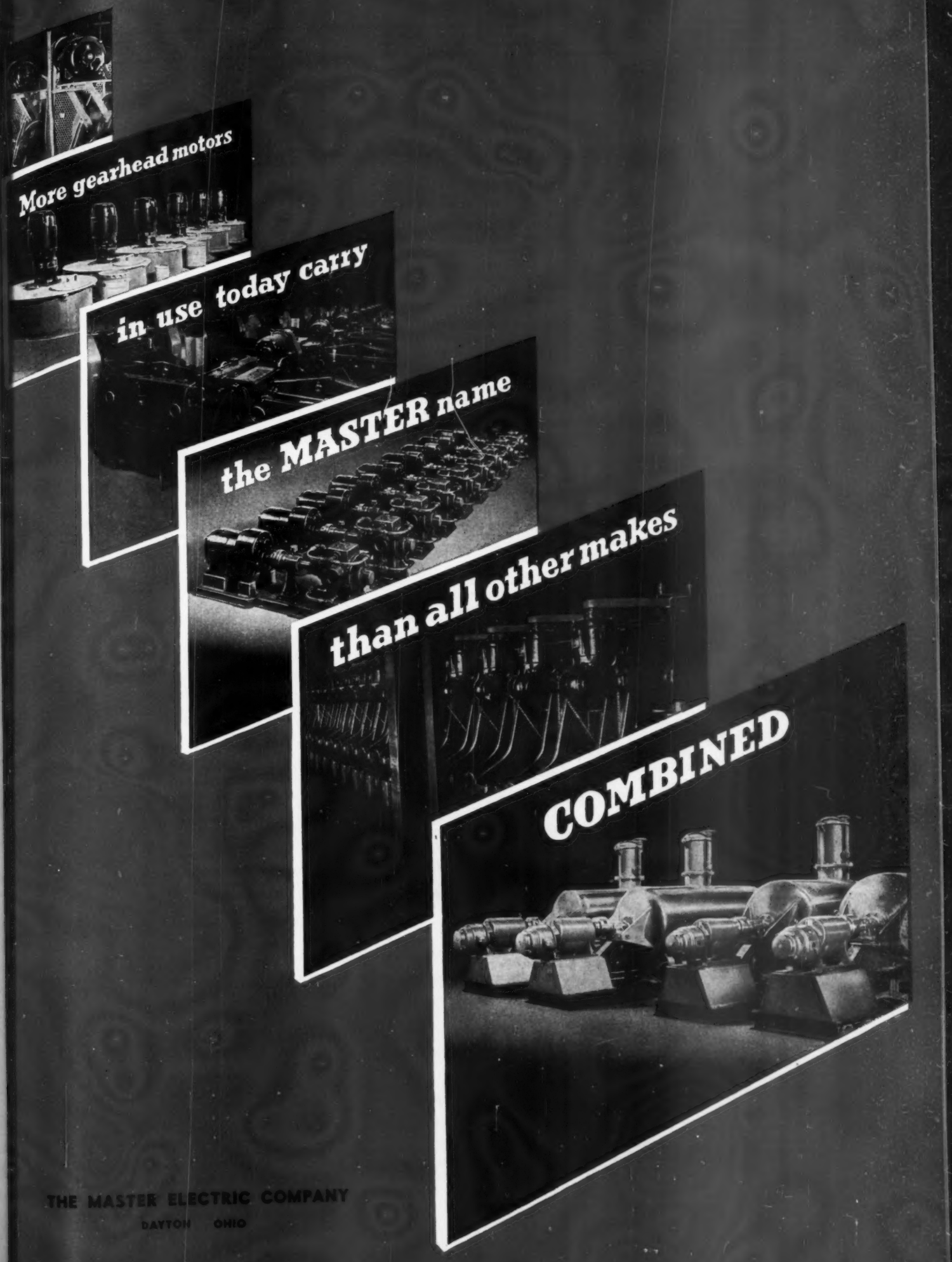
Failure to Pick Up
(*a*) Low voltage
(*b*) Coil open
(*c*) Mechanical binding
(*d*) Wrong coil
(*e*) Shorted turns
(*f*) Excessive magnet gap
(*g*) Mechanical overload

Miscellaneous Mechanical Troubles
(*a*) Overvoltage
(*b*) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
(*c*) Chattering
(*d*) Abrasive dust
(*e*) Underload

Noisy Magnet
(*a*) Broken pole shader
(*b*) Magnet faces not true due to wear or mounting strains
(*c*) Dirt on magnet
(*d*) Low voltage
(*e*) Mechanical overload
(*f*) Load out of alignment

Wear on Magnet
(*a*) Overvoltage

(CONTINUED ON PAGE 112)


More gearhead motors
in use today carry
the MASTER name
than all other makes
COMBINED
THE MASTER ELECTRIC COMPANY
DAYTON OHIO

(CONTINUED FROM PAGE 110)

Table I. Types of Control Troubles and Their Causes

(b) Underload
(c) Broken pole shader
(d) Wrong coil
(e) Chattering
(f) Load out of alignment

SOLENOIDS, D. C.

Coil Failure
(a) Overvoltage
(b) High ambient temperature
(c) Wrong coil
(d) Moisture
(e) Corrosive atmosphere
(f) Intermittent coil energized too long
(g) Holding resistor not cut in
(h) Mechanical failure of coil

Failure to Drop Out
(a) Mechanical binding
(b) Gummy substance on magnet faces
(c) Airgap in magnet destroyed
(d) Voltage not removed

Failure to Pick Up
(a) Low voltage
(b) Coil open
(c) Mechanical binding
(d) Wrong coil
(e) Shorted turns
(f) Excessive magnet gap
(g) Mechanical overload

Miscellaneous Mechanical Troubles
(a) Overvoltage
(b) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
(c) Chattering
(d) Abrasive dust
(e) Underload

STARTERS, MANUAL

Reduced or Full Voltage (Small Sizes)
Contact Tip Troubles (see Table II)

Failure to Reset
(a) Broken mechanism
(b) Corrosion
(c) Dirt
(d) Worn parts
(e) Resetting too soon

Failure to Trip (Motor Burnout)
(a) Wrong-sized heater
(b) Mechanical binding
(c) Relay previously damaged
(d) Dirt
(e) Corrosion
(f) Motor and relay in different ambient temperatures

Insulation Failure
(a) Moisture
(b) Acid fumes
(c) Overheating
(d) Dirt on surfaces
(e) Voltage surges
(f) Short circuits

Mechanical Failures
(a) Abrasive dust and dirt
(b) Misapplication
(c) Mechanical damage

SWITCHES, FLOAT

Burning or Welding of Contacts and Shunts
(a) Shorts on control circuits with too-large protecting fuses
(b) Severe vibration
(c) Dirt
(d) Oxidation

Insulation Failure
(a) Moisture
(b) Acid fumes
(c) Overheating
(d) Dirt on surfaces
(e) Voltage surges
(f) Short circuits

Mechanical Failures
(a) Abrasive dust and dirt
(b) Misapplication
(c) Mechanical damage

Sticking
(a) Dirt
(b) Worn parts
(c) Improper adjustment
(d) Corrosion
(e) Mechanical binding

SWITCHES, FLOW

Burning or Welding of Contacts and Shunts
(a) Shorts on control circuits with too-large protecting fuses
(b) Severe vibration
(c) Dirt
(d) Oxidation

Insulation Failure
(a) Moisture
(b) Acid fumes
(c) Overheating
(d) Dirt on surfaces
(e) Voltage surges
(f) Short circuits

Leaks
(a) Corrosion
(b) Mechanical damage
(c) Excessive pressure

Mechanical Failures
(a) Abrasive dust and dirt
(b) Misapplication
(c) Mechanical damage

Sticking
(a) Dirt
(b) Worn parts
(c) Improper adjustment
(d) Corrosion
(e) Mechanical binding

SWITCHES, KNIFE

Heating
(a) Overcurrent
(b) Loose connection
(c) Spring clips loose or annealed
(d) Oxidation
(e) Corrosion

SWITCHES, LIMIT

Burning or Welding of Contacts and Shunts
(a) Shorts on control circuits with too-large protecting fuses
(b) Severe vibration
(c) Dirt
(d) Oxidation

Contact Tip Troubles (see Table II)

Insulation Failure
(a) Moisture
(b) Acid fumes
(c) Overheating
(d) Dirt on surfaces
(e) Voltage surges
(f) Short circuits

Mechanical Failures
(a) Abrasive dust and dirt
(b) Misapplication
(c) Mechanical damage
(d) Excessive operating speeds

SWITCHES, MASTER

Burning or Welding of Contacts and Shunts
(a) Shorts on control circuits with too-large protecting fuses
(b) Severe vibration
(c) Dirt
(d) Oxidation

Insulation Failure
(a) Moisture
(b) Acid fumes
(c) Overheating
(d) Dirt on surfaces
(e) Voltage surges
(f) Short circuits

Mechanical Failures
(a) Abrasive dust and dirt
(b) Misapplication
(c) Mechanical damage

SWITCHES, PRESSURE

Burning or Welding of Contacts and Shunts
(a) Shorts on control circuits with too-large protecting fuses
(b) Severe vibration
(c) Dirt
(d) Oxidation

Insulation Failure
(a) Moisture
(b) Acid fumes
(c) Overheating
(d) Dirt on surfaces
(e) Voltage surges
(f) Short circuits

Leaks
(a) Corrosion
(b) Mechanical damage
(c) Excessive pressure

Mechanical Failures
(a) Abrasive dust and dirt
(b) Misapplication
(c) Mechanical damage

Sticking
(a) Dirt
(b) Worn parts
(c) Improper adjustment
(d) Corrosion

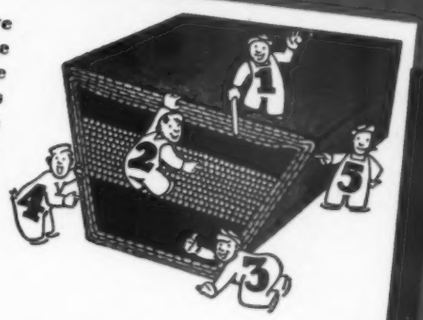
(CONTINUED ON PAGE 114)

Not one but F·I·V·E *reasons why you will*

REDUCE BELTING COSTS... INCREASE PRODUCTION WITH *Gilmer* "PLUS-POWER" V-BELTS

Here are the five outstanding features that have made thousands of plants, large and small, switch to Gilmer "Plus-Power" V-Belts:

Any belt manufacturer can say "My belt will give better performance than others, will minimize shutdowns for replacement, will deliver the maximum of power, will last longer." But today's hard-headed plant superintendent, maintenance engineer and purchasing agent want *facts.* Not generalities but concrete facts *why* a belt will do what is claimed for it. With industry stepping up production to meet urgent national defense needs, these facts are more important today than ever before, for a shutdown through belt failure is a minor calamity.



Gilmer **Top Tension Rubber** ... Here's the secret of the famous Gilmer no-slip grip. As the belt flexes around the sheave it bulges, creating lateral stress across the belt's entire thickness, thus locking the belt into working position and insuring maximum transmission of power.

Gilmer **Rubber-Locked Pulling Cords** ... Under Gilmer's manufacturing process, rubber penetrates the cords, securely gripping each strand, preventing their loosening despite thousands of flexes. By thus bonding each cord in working position, destructive internal friction and generation of heat are prevented.

Gilmer **Heat-Resisting Bottom Rubber** ... Internal heat hastens deterioration. Gilmer compounded rubbers lengthen belt life by producing lower operating temperatures, as the bottom rubber is subjected to constant compression and elongation.

Gilmer **Heavy Jackets** ... Besides furnishing protection to the belt's working parts, the multiple jackets permit the ready unlocking of Gilmer belts when they straighten out to leave the sheave. The jackets also protect the walls of the groove against excessive wear.

Gilmer **Controlled Stretch** ... The Gilmer process that controls stretch reduces time lost for take-ups from excessive belt stretching. In addition, the maximum accuracy in matched lengths is thus assured, with every belt doing its proper share.

L. H. GILMER COMPANY

TACONY, PHILADELPHIA

The Oldest Firm of Rubber Fabric Belt Specialists

Still another reason for Gilmer superiority is this: Gilmer V-Belts are made by belting specialists, on the largest assortment of V-moulds in the world. Install Gilmer V-Belts on your most troublesome drive and check the results.

(CONTINUED FROM PAGE 112)

Table I. Types of Control Troubles and Their Causes

(*e*) Mechanical binding

SWITCHES, SELECTOR

Burning or Welding of Contacts and Shunts
(*a*) Shorts on control circuits with too-large protecting fuses
(*b*) Severe vibration
(*c*) Dirt
(*d*) Oxidation

Failure to Break Arc
(*a*) Too much current
(*b*) Too much voltage (usually d.c.)
(*c*) Misapplication
(*d*) Too much inductance

Failure to Make Contact
(*a*) Mechanical damage
(*b*) Dirt
(*c*) Corrosion
(*d*) Wear allowance gone

Insulation Failure
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

Mechanical Failures
(*a*) Abrasive dust and dirt
(*b*) Misapplication
(*c*) Mechanical damage

SWITCHES, SPEED SENSITIVE

Burning or Welding of Contacts and Shunts
(*a*) Shorts on control circuits with too-large protecting fuses
(*b*) Severe vibration
(*c*) Dirt
(*d*) Oxidation

Insulation Failure
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

Mechanical Failures
(*a*) Abrasive dust and dirt
(*b*) Misapplication
(*c*) Mechanical damage
(*d*) Excessive operating speeds

Sticking
(*a*) Dirt
(*b*) Worn parts
(*c*) Improper adjustment
(*d*) Corrosion
(*e*) Mechanical binding

THERMOSTATS, BIMETALLIC

Arcing and Burning of Contacts
(*a*) Misapplied
(*b*) Should handle very little current and have sealing circuit

Insulation Failure
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

THERMOSTATS, EXPANDING FLUID

Bellows Distorted
(*a*) Mechanical binding
(*b*) Temperature allowed to overshoot

Bulb Distorted
(*a*) Liquid frozen in capillary tube

Burning or Welding of Contacts and Shunts
(*a*) Shorts on control circuits with too-large protecting fuses
(*b*) Severe vibration
(*c*) Dirt
(*d*) Oxidation

Insulation Failure
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

THRUSTORS

Short Life of Thrustor
(*a*) Abrasive dust
(*b*) Dirty oil
(*c*) Water in tank

TRANSFORMERS

Insulation Failure
(*a*) Overheating
(*b*) Overvoltage
(*c*) Voltage surges
(*d*) Moisture
(*e*) Mechanical damage

Overheating
(*a*) Overload
(*b*) Overvoltage
(*c*) Intermittent-rated device on too long

VALVES, A. C.

Coil Failure
(*a*) Moisture
(*b*) Overvoltage
(*c*) High ambient temperature
(*d*) Failure of magnet to seal in on pickup
(*e*) Too-rapid duty cycle
(*f*) Corrosive atmosphere
(*g*) Chattering of magnet
(*h*) Metallic dust
(*i*) Handling fluid above rated temperature

Failure to Open or Close
(*a*) Mechanical binding
(*b*) Gummy substance on magnet faces
(*c*) Airgap in magnet destroyed
(*d*) Voltage not removed
(*e*) Corrosion
(*f*) Scale
(*g*) Dirt
(*h*) Operating above rated pressure

Leaks and Mechanical Failure
(*a*) Worn seat
(*b*) Solid matter in seat (check strainer ahead of valve)

Noise
(*a*) Broken pole shader
(*b*) Magnet faces not true due to wear or mounting strains
(*c*) Dirt on magnet
(*d*) Water hammer

Wear on Magnet
(*a*) Overvoltage
(*b*) Underload
(*c*) Broken pole shader
(*d*) Wrong coil
(*e*) Chattering
(*f*) Load out of alignment

VALVES, D. C.

Coil Failure
(*a*) Overvoltage
(*b*) High ambient temperature
(*c*) Wrong coil
(*d*) Moisture
(*e*) Corrosive atmosphere
(*f*) Intermittent coil energized continuously
(*g*) Holding resistor not cut in
(*h*) Handling fluid above rated temperature

Failure to Open or Close
(*a*) Mechanical binding
(*b*) Gummy substance on magnet faces
(*c*) Airgap in magnet destroyed
(*d*) Voltage not removed
(*e*) Corrosion
(*f*) Scale
(*g*) Dirt
(*h*) Operating above rated pressure

Leaks and Mechanical Failure
(*a*) Worn seat
(*b*) Solid matter in seat (check strainer ahead of valve)

VALVES, MOTOR OPERATED

Failure to Open or Close
(*a*) Corrosion
(*b*) Scale
(*c*) Dirt
(*d*) Mechanical binding
(*e*) Damaged motor
(*f*) No voltage

Leaks and Mechanical Failure
(*a*) Worn seat
(*b*) Solid matter in seat (check strainer ahead of valve)

VALVES, THRUSTOR OPERATED

Failure to Open or Close
(*a*) Corrosion
(*b*) Scale
(*c*) Dirt
(*d*) Mechanical binding
(*e*) Damaged motor
(*f*) No voltage

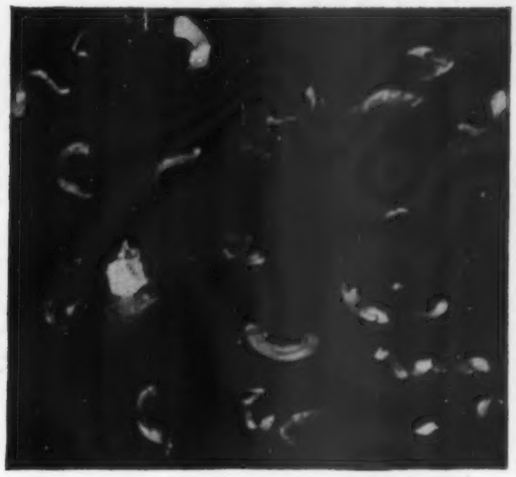
Leaks and Mechanical Failure
(*a*) Worn seat
(*b*) Solid matter in seat (check strainer ahead of valve)

Short Life of Thrustor
(*a*) Abrasive dust
(*b*) Dirty oil
(*c*) Water in tank

(TO BE CONTINUED)

Make the "Chips Test"—and you'll specify DISSTON BITE-RITE FILES

THESE LONG, CURLING CHIPS cut by a Disston Bite-Rite File prove that more metal is taken off with each stroke. Hence, fewer strokes and faster filing.



UNEVEN FRAGMENTS removed by an ordinary file indicate slower filing, and not as smooth a filed surface.

If you want to cut filing costs and speed up production in your plant, try this simple test. Take a few strokes with a Disston Bite-Rite File on a metal specimen, and save the chips. Now repeat this operation, using an ordinary file. Compare the two sets of chips.

Notice how the majority of the chips cut by the Disston Bite-Rite File are heavy, long and curling—like chips from a lathe tool. Contrast them with the greater percentage of short, light, uneven fragments cut by the ordinary file.

These chips show how you can make important savings. Disston Bite-Rite Files take off more metal with each stroke, so that fewer strokes are required. This *faster filing* saves your workmen minutes that add up to dollars of profit.

And Disston Bite-Rite Files, with their staggered teeth and self-cleaning gullets, produce smoother filed surfaces. Files last longer, too, because the teeth are designed to cut—not scrape.

Ask your distributor to supply you with Disston Bite-Rite Files for the "Chips Test." Convince yourself—as many others have—that you can get better, speedier production, lower costs and increased profits by using Bite-Rite Files. Henry Disston & Sons, Inc., Philadelphia, Pa.

THERE'S A DISSTON BITE-RITE FILE FOR EVERY JOB. Your distributor can supply you with Disston Bite-Rite Files in practically every shape needed for machine shop service and in three different cuts: *Smooth Cut,* the finest; *Second Cut,* the next finest; and *Bastard,* coarse cut. Mill Files are also available in these three cuts and a fourth, *Mill Fine Bastard Cut.* Ask your mill supply house to help you select the right files for each job from the complete line of Disston Bite-Rite Files.

DISSTON BITE-RITE FILES

DISSTON HAS THE EDGE

for All Electrical Servicing use this new HICKOK UNIVERSAL POWER ANALYZER

Measures Volts, Amperes, and Watts in single and polyphase, 2 and 3 wire circuits . . . . . .

Rotary switch permits current measurements in any of three wires by inserting ammeter in desired circuit. Voltage can be measured across any two of three wire circuits.

Two element, polyphase wattmeter measures power consumed in both polyphase and single phase circuits.

RANGES: In regular Model 903 Volts to 650 volts, Amperes to 52 amps. Watts to 20,000 watts. With necessary C-104 Transformers higher ranges to 520 amps. and 200 KW are available.

Write for literature and complete information.

ADDRESS ALL INQUIRIES TO
THE HICKOK ELECTRICAL INSTRUMENT CO.
10514 DUPONT AVE. • CLEVELAND, OHIO, U.S.A.

You Want to Know

more about the items mentioned on this page. Letters to the addresses given will bring information

• FIRE PROTECTION of rotating electrical machines is provided by shielded nozzles which discharge carbon dioxide into generator ventilating ducts when fire flames up. The nozzles have low-jet velocity to eliminate turbulence and to insure effective distribution of the gas. Walter Kidde & Co., 140 Cedar St., New York.

• HUMOROUS PAMPHLET packed with facts to consider in choosing a slide rule is the most readable, most understandable instruction book on that indispensable tool we've ever seen. Explains application of various types and tells how they differ. Keuffel & Esser Co., Adams and Third Sts., Hoboken, N. J.

• AIRPLANE and other manufacturers facing the problem of securing metal sheets to each other and to adjoining structural members prior to riveting will find one solution in a sheet-holding device consisting of a small steel cylinder with spring-actuated locking plunger. Applied with a forceps, it clamps and holds work together with 50 lb. pressure, it is said. Sizes $\frac{3}{32}$ to $\frac{5}{16}$ inch. The Cleveland Pneumatic Tool Co., 3734 East 78th St., Cleveland.

• LOW-TEMPERATURE welding and brazing eutectic alloys in rod form bind on the heated surface of most any metal. Base metal does not melt and there is complete fusion of the molten rod with heated surface, it is said. Useful in joining and overlaying similar and dissimilar metals. The Eutectic Welding Alloys, Inc., 40 Worth St., New York.

• PUMPING unit injects chemical compounds into hot-water and steam systems against pressures up to 250 lb. so that scale can be removed without boiler shutdown. The 2-watt variable-speed motor may be adjusted to control periodical injections or may be equipped with a metering device for proportionate feeding of various fluids. James Research Laboratories, Chicago.

• ORNERY SCREWS in difficult places can be inserted or removed by an expanding-bit-type screw-holding driver made in sizes and lengths appropriate for radio, electrical, photographic, automotive, and office-equipment use. H. J. J. Co., 1945 Franklin St., Oakland, Calif.

• CLEANER containing no free acid removes dirt, scum, and stains from washroom fixtures and drinking fountains without removing the finish. Effective with hard or soft water. Bradley Washfountain Co., Bradex Department, North 22d and West Michigan Sts., Milwaukee.

• BRASS-PLATING PROCESS yields a smooth bright deposit of uniform color and predetermined thickness—0.001 of an inch or more—two to four times as rapidly as present processes, it is said. Prepared high-speed brass salts provide a bath which eliminates the "breaking-in" period and plates immediately. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

FERRETING OUT the causes and cures of troublesome machine vibrations is simplified through the use of an 8-oz. meter that indicates frequencies present in a vibrating body oscillating 500-20,000 cycles per minute. Where more than one vibrating frequency exists the meter indicates maximum amplitude for each. It also detects vibrations in differing planes. Westinghouse Electric & Mfg. Co., Research Products Department, Radio Division, Baltimore

• STANDARDS presented for adoption by the American Standards Association include the tolerances to which toolroom and engine lathes are being built and the tests by which these tolerances may be checked. National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland.

• TIME spent in making labels for bin and file tabs, cabinets, and letter files is reduced, they say, through use of Lifetime Labels made in 15 sizes, 5 colors, plain or white or ruled. Special machine attaches a Cellophane cover to them. And, we understand, even narrow ones don't slip in the typewriter. The Paper House, Butler Bin Bldg., Waukesha, Wis.

• HARDWOOD, produced from green soft wood through impregnation with synthetic phenol formaldehyde resins and extraction of sap and moisture, is said to cost $\frac{1}{3}$ to $\frac{1}{2}$ less than natural hardwoods. The synthetic hardwood is warp proof,

SUNICUT
Made Cutters Behave!
Saved $50 per thousand parts

A large automotive plant was cutting serrations on transmission shafts at the rate of 1650 pieces per cutter . . . with cutter costs at $54.44 per thousand pieces.

Then they changed to SUNICUT, a clear, transparent, sulphurized cutting oil — up went pieces produced and down went cutter costs. Pieces per cutter-grind increased from 50 to 200 . . . cutter costs dropped from $54.44 to $4.50 per thousand . . . and output increased from 1650 to 20,000 pieces per cutter.

Such performance is typical of how SUN Industrial Petroleum Products are helping Industry meet today's demands of increased output at lower costs. Whatever your production problems, in any industry, it will be worthwhile calling in a SUN Technical Representative for full details.

SUN OIL CO., PHILADELPHIA

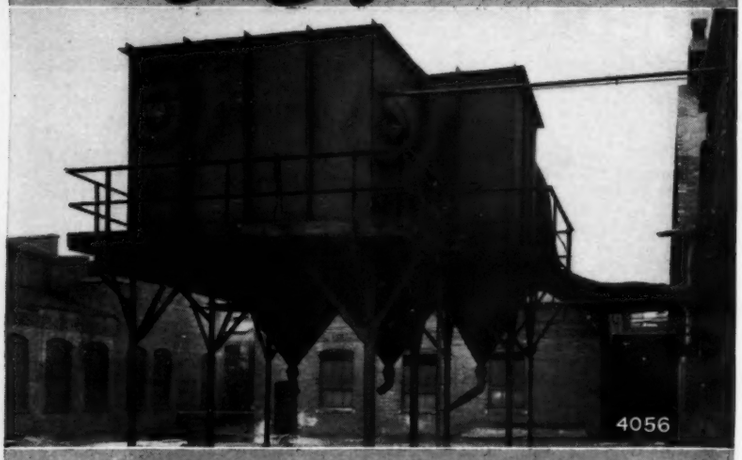
SUN PRODUCTS INCLUDE

Cutting Oils
Processing Oils
Lubricating Oils and Greases
Mineral Spirits
Diesel Lubricants
Quenching and Tempering Oils

SUN OILS

PETROLEUM PRODUCTS FOR ALL INDUSTRIES

"A Cleaner Product BETTER SANITARY CONDITIONS" with SLY DUST CONTROL



Sly Dust Filters at plant of The Fairbanks Co., Binghamton, N. Y.

THESE are the results which Sly Dust Control has brought The Fairbanks Company of Binghamton, N. Y.

Exhausting the dust and dirt from tumbling mills in their foundry, these Sly Dust Filters have produced better working conditions for employees, have improved general shop operations and have helped make a cleaner product.

This is what Sly is doing nationwide. Sly Dust Filters collect over 100 different kinds of dust in 56 industries. They produce better working conditions — aiding quality and quantity of production, reducing operating costs, adding to saleability of product.

Yet Sly Dust Filters are not expensive. They are most economical in space and power. They bring startling savings. They soon repay their cost by increased plant efficiency, reduced hazards, better employee relations and a cleaner product or package with greater sales appeal. Ask for bulletin 98 . . . tell us your problem so we can write you fully.

THE W. W. SLY MFG. CO.

Branch Offices in Principal Cities

4755 Train Avenue Cleveland, Ohio

SLY
INDUSTRIAL DUST CONTROL

fire resistant, and rot proof; retains its size under various atmospheric conditions; and can be used in airplanes, gun and machine mountings, ships, brush backs, shuttles, furniture. Paul S. Hanway and Associates, 67 Hobart St., Ridgefield Park, N. J.

• CARBON BRUSH CONCAVER forms face of new brush to fit curvature of commutator or slipring surface in much less time than the job could be done by the "sand-in" method. Operates from electric motor or electric drill. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

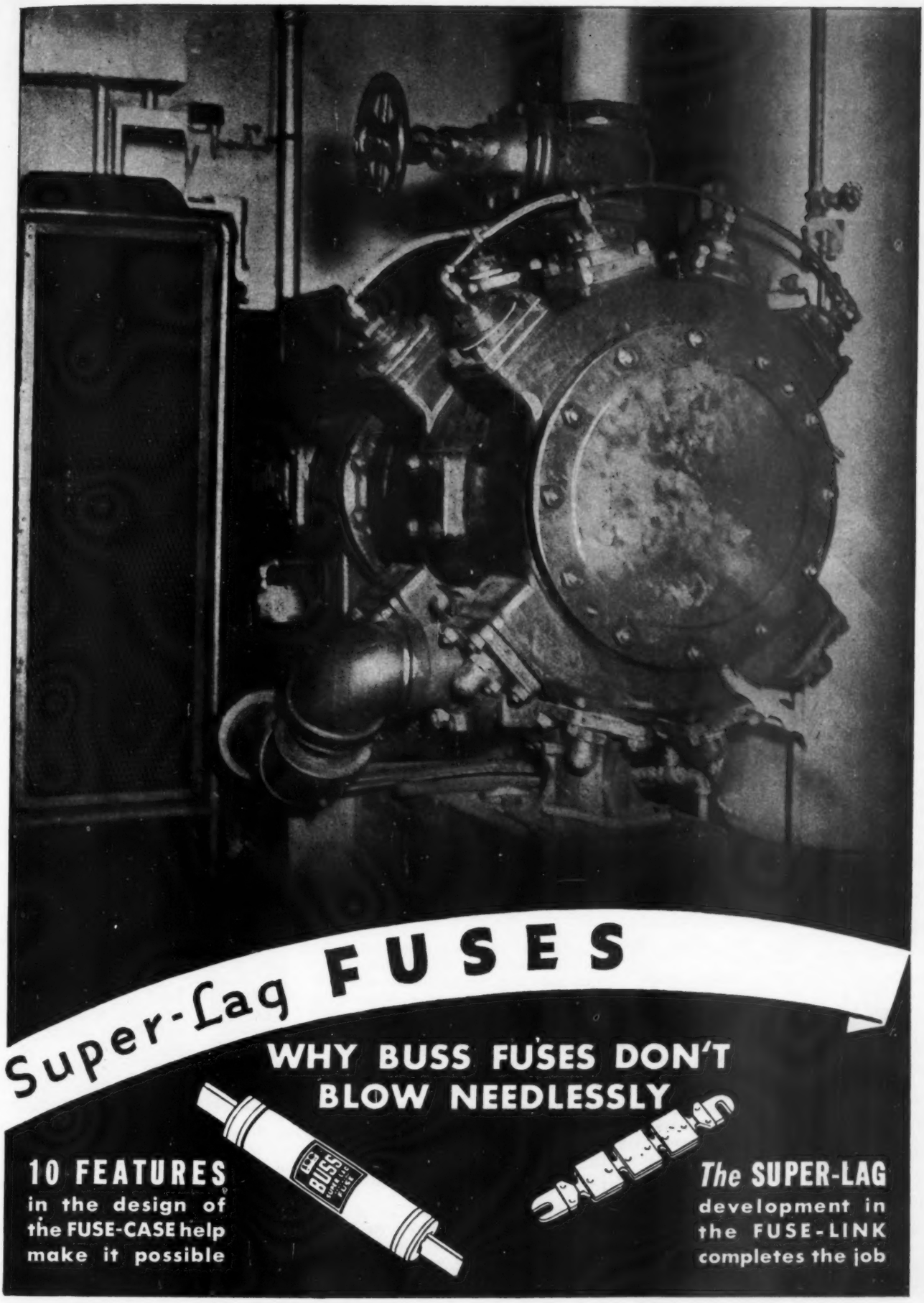
• TRAINING COURSE in the fundamentals of oxyacetylene welding and cutting consists of two books containing, in one (50c.), a complete set of worksheets, and in the other ($1), supplementary lecture material. For personal or class use. Air Reduction Sales Co., 60 East 42d St., New York.

• HEAT-RESISTANT ALLOY of columnbium finds use at high temperatures where more expensive steels containing molybdenum, tungsten, and vanadium have hitherto been required. One of the first applications will be in steam turbines. General Electric Co., Schenectady, N. Y.

DICTATING RECORDER for busy executives features versatile microphone having five switch positions—for use near the lips, normal dictation two feet from dictator, dictation from a standing position, conference recording of voices within twenty feet, direct recording of radio broadcasts. Set consists of microphone, recorder, unbreakable disks, transcriber for secretary. The SoundScriber Corp., 82 Audubon St., New Haven, Conn.

• DIRECTIONAL CONTROL of fluorescent lighting and elimination of glare are provided by a transparent plastic sheeting in which parallel thin translucent louvers are embedded. Louvers may be colored or white. In proper fixture design the sheeting appears translucent within the normal field of vision, transparent with fine or translucent lines from other positions. Doane Products Corp., Meriden, Conn.

• OILS, fats, and greases cannot attack hands guarded by gauntlet or knit wrist-type canvas work gloves coated with neoprene. Miller Rubber Co., Akron, Ohio.


Super-Lag FUSES
WHY BUSS FUSES DON'T BLOW NEEDLESSLY
10 FEATURES
in the design of the FUSE-CASE help make it possible
BUSS
The SUPER-LAG
development in the FUSE-LINK completes the job

FACTS You Should Know About INDUSTRIAL HUMIDIFICATION

EVERY factory executive who wants to be fully informed about INDUSTRIAL HUMIDIFICATION during the winter heating season should send for a copy of this new 8 page educational bulletin. It contains a wealth of handy data for calculating losses due to dry air . . . humidification needed to correct conditions . . . and recommendations on installation and use of humidifiers. ASK FOR YOUR COPY.

Armstrong Humidifiers are exceptionally economical to install and use —thanks to their high capacity and simple operating principle. All units are built for heavy duty industrial service and are sold on a "money-back" guarantee. For complete information write ARMSTRONG MACHINE WORKS, 804 Maple St., Three Rivers, Michigan.

THE Type CK-2 Humidifier lists at $100.00, complete with Friez humidistat, solenoid control valve, fan, strainer, and condensate drainage trap. Capacity to handle 40,000 cu.ft. of space under average conditions. Larger sizes are even more economical on a capacity basis.

ARMSTRONG
STEAM TYPE
HUMIDIFIERS

What's New in Equipment

Fluorescent Lamp

The 100-watt 60-in. lamp extends benefits of fluorescent lighting to high-ceiling

interiors and provides high levels of illumination to large areas—said to produce an average of 880 lumens per foot. It has a Mogul Bi-Pin base and Mirastat starter. Now available in white, will be available in "daylight." Hygrade Sylvania Corp., Salem, Mass.

Screw, Bolt, and Washer Assemblies

Springtite assemblies are assembled so that the washer can't come off the screw. This feature eliminates hand assembly of screw and washer, facilitates assembly in hard-to-get-at places, insures correct washer on proper bolt or screw. The hexagonal-head capscrew is pre-assembled with a Springlock which makes it useful where an extra tight assembly is desired. The round-head machine screw is pre-assembled with a Gripit tension washer making it useful for light work. The fillister-head capscrew is pre-assembled with a Knolink spring washer to provide adequate protection from looseness over a wide reactive range and automatically compensate for wear and looseness. Eaton Mfg. Co., Reliance Spring Washer Division, Massillon, Ohio.

Lamp Lock

Lamp lock for brass and porcelain sockets, weatherproof socket for locking electric light bulbs. The latter has a locking device attached which makes use of convolutions on outside of threaded brass ferrule. Large end of tapering coil spring is screwed into socket leaving three or four turns of spring exposed. Protecting ring with notch at top is dropped over light bulb and bulb is screwed into the socket engaging the exposed spring turns in the thread on the bulb base. Laduby Co., New Haven, Conn.

Extended Inner-Ring Bearings

Style A, in fractional inch dimension bores, shaft diameters $\frac{5}{8}$ to $2\frac{15}{16}$ inches. Features claimed: Permanently sealed, pre-lubricated, fitted with location snap-ring to permit through-bore in housing, locked on shaft with either knurled cup point set-screws or $\frac{1}{2}$ dog point setscrews with lock wire. The bearings are for machine applications on straight shafts. Annular grease groove with 2 holes in outer diameter of outer race permits re-greasing. Stephens-Adamson Mfg. Co., Aurora, Ill.

Inter-Room Communication

The Philcophone 2-way communicating phone for inter-room communication consists of a master station unit and one remote station. The master station is enclosed in a plastic cabinet equipped with five push-button controls so that four additional remote stations may be connected

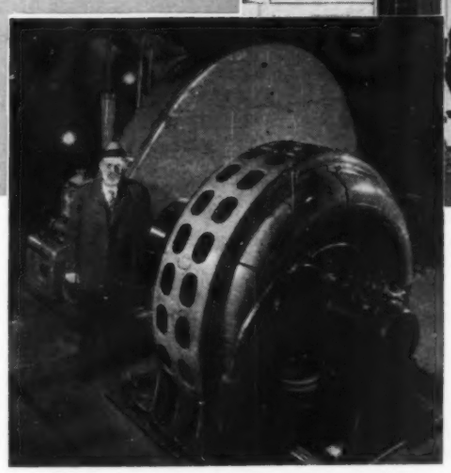
to the master station. The remote stations are housed in a small metal casing similar in appearance to a microphone and are equipped with 50 ft. of three-wire cable. A sixth button is marked "Quiet". When it is depressed, no sound can be heard from the remote stations until someone on a remote station pushes the "talk" button on the remote control receiver. Philco Corp., Tioga and C Sts., Philadelphia.

(*Continued on page 126*)

600 HORSES FLATTEN THE HILLS OF SAN FRANCISCO!

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Yes! Two Allis-Chalmers 300-Horsepower Motors Operate San Francisco's Historic California Street Cable Car System Over Hills as Steep as 21%! What's More — They've Given 26 Years of Notable Day-After-Day Service . . . With Never A Motor Failure! Find Out How to Get This Same Type of Dependable, Low-Cost Motor Performance in Your Plant!



TWO ALLIS-CHALMERS 300-HORSEpower motors keep eleven miles of underground cable in steady motion 20 hours a day to operate the famous California Street cable cars. Shown here with one of the motors is 86-year old James W. Harris who recently retired as president of the company.

YOU GET a different kind of a street car ride in San Francisco . . .

As part of the picturesque background of this colorful city, cable cars climb hills that would balk ordinary trolley cars . . . grades as sharp as 21%! And down under the tracks are moving continuous cables . . . eleven miles of them . . . kept going at a steady pace of 8½ miles per hour by two Allis-Chalmers 300-Hp Lo-Maintenance Motors located at the central station.

No Motor Failures In 26 Years

There's a fascinating story here. Built by Governor Leland Stanford in 1878 . . . destroyed in the earthquake and fire of 1906 . . . the California Street Cable Railroad occupies a unique place in municipal street transportation systems. But that's only part of it —

For the Allis-Chalmers Motors are doing a behind-the-scenes job that is equally interesting to every motor user. Providing power to operate 60,000 feet of underground cable . . . running an average of twenty hours a day . . . there's never been a motor failure with these motors since they were installed 26 years ago! Significantly, it's the same kind of dependable, long-life, low-cost service that Lo-Maintenance Motors have given in thousands of other industrial installations all over the country.

If this is the type of motor performance you want in your plant, get the facts about Lo-Maintenance Motors. The engineer in the district office near you will be glad to give you the information you want. Or you can write Allis-Chalmers, Milwaukee, Wisconsin.

A 1316

Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

ALLIS-CHALMERS

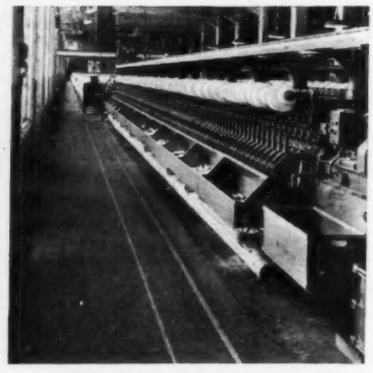
MILWAUKEE · WISCONSIN

THE INDUSTRIAL FLOORING *THAT CAN TAKE IT*

● Receiving-shipping department, Hennegan Co., Cincinnati, Ohio.

Carey Elastite

ASPHALT TILE



● Maverick Mills, East Boston, Mass.

THIS improved flooring, a development of CAREY research, is tougher, longer wearing—a flooring that can take a beating from wheeled traffic and yet that is resilient and comfortable for workmen. It reduces accidents and steps-up efficiency. Withstands highly compressive loads and rough usage.

An ideal material for factory, warehouse and machine shop floors; loading platforms; offices; laboratories; stores. It is fire-safe, moisture and weather resistant. Also specified for protection of built-up roofs subjected to traffic—makes them valuable for use as sun decks or recreational activities.

CAREY ELASTITE Asphalt Tile is a compound of asphalt and mineral filler, reinforced with asbestos fibres, densely compressed and die cut to size. Available in black and red colors in ½″ thickness, and in sizes 12″ x 12″ and 12″ x 24″.

This modern tile helps to reduce accidents, lower maintenance, save time, improve appearance, promote cleanliness. Specify it for new construction and for resurfacing rough or worn floors.

● Hava-tampa Cigar Factory, Tampa, Florida

Write today for catalog and samples—address Dept. 31

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio

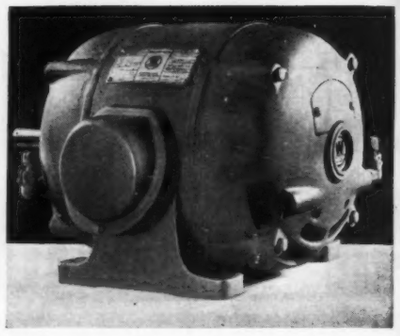
Dependable Products Since 1873

IN CANADA: THE PHILIP CAREY COMPANY, LTD. Office and Factory: LENNOXVILLE, P. Q.

(*Continued from page 124*)

Polyphase Induction Motors

New open-type sleeve-bearing squirrel-cage induction motors designed especially for general-purpose drive applications such as machine tools, pumps, and auxiliary drives have been announced. Designated as Type CS, these motors are available in



ratings from ½ to 5 hp., with speeds ranging 875-3,600 r.p.m., for operation on 2 and 3-phase a.c. circuits at 110, 220, 440, and 550 volts.

These motors are the result of an extensive program of motor redesign adopted for the purpose of taking advantage of all the advances that have been made in materials and design technique during the past few years. Improvements in silicon steels make it possible for a smaller amount of iron than used heretofore to produce the same horsepower. New synthetic materials having higher dielectric strength have permitted a reduction in the space required for coil insulation without any sacrifice in the quality of protection.

In designing these motors the requirements of the new NEMA standards, which became effective October 1, have been adhered to in every respect. Among the features of the new line are a decided reduction in size and weight for a given horsepower. For example, a CS motor rated 1½ hp. weighs 25 percent less and occupies 27 percent less space than previous designs of the same speed rating.

All-cast frames have been redesigned to give greater strength and rigidity with lower weight. Other improvements affecting frame design include new sealed sleeve bearings having a combination vestibule and felt washer seal, and larger oil reservoir capacity. Oil filler cups may be placed on either side of the motor.

Housings and seals for ball bearings have likewise been improved.

Contour of the frame has been improved by eliminating sharp corners and projections. The standard finish is a light machine tool gray.

Use of new wire insulation is claimed to give maximum dielectric strength, toughness, and flexibility. Windings are protected from abrasion by combination slot cells with reinforced cuffs.

Coil ends are taped to give them greater strength to resist stresses produced by full-voltage starting.

As part of the inspection procedure, windings are given a high-voltage radio-frequency test. All rotors are dynamically balanced. Westinghouse Electric & Mfg. Co., East Pittsburgh.

(*Continued on page 128*)

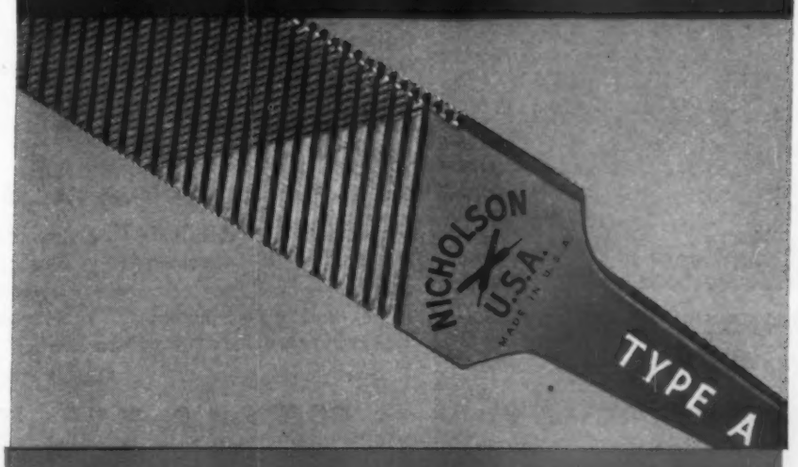
Tremendous Trifles

GUN-SIGHTS gaged in micrometric scale ... Diesel-engine injection valves machined to millimeter smallness . . . airplane propellers balanced to a fraction of an ounce. Tremendous trifles! — when translated into terms of results.

So, too, are the exacting structure and measurements of the teeth of Nicholson special-purpose files designed for specific results on specific metals . . . results in speed or efficiencies not consistently possible with general-purpose files.

Nicholson or Black Diamond Type A Aluminum files, for example: Microscopic examination reveals teeth which themselves have still finer teeth—saw-like edges (invisible to the naked eye) which break up the ductile-metal filings and prevent chatter. "Open throat cut" further enables this file to clear itself. Faster metal removal, more accurate finish—*better products*—are inevitable!

Such are some of the infinite pains taken to give long-life efficiency to the many specialized files designed by file specialists . . . and to enable this, the world's largest file manufacturer, to guarantee *Twelve perfect files in every dozen.*



TYPE A ALUMINUM **files are made in Flat and Half-round shapes, 6″ to 16″ in length—and all in one degree of coarseness.** ***Free Technical Bulletin gives further information.***

NICHOLSON FILE COMPANY, PROVIDENCE, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES

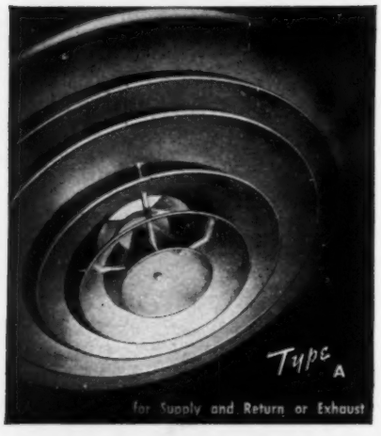
FOR EVERY PURPOSE

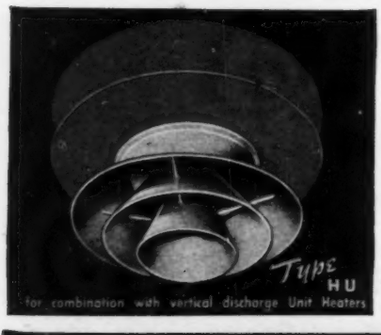
Insure the Success of Your Factory Air Conditioning

with

ANEMOSTAT

DRAFTLESS AIR DIFFUSERS





THE purpose of an air conditioning, air heating or ventilating system is to provide atmospheric conditions conducive to the health, comfort and efficiency of workers.

If there are drafts — pockets of dead, stale air — clammy, sticky spots — hot and cold areas — then the system is a failure.

If, on the other hand, **draftless, comfortable, healthful atmospheric conditions are constantly maintained** the system is a success.

Whether these essential conditions are maintained depends on the efficiency of the method used to introduce the conditioned air into the working quarters. This is known as AIR DISTRIBUTION. Hence, every factory Owner and Manager will see the vital need for insuring efficient air distribution. Here's how it can be done — **Equip all air supply outlets with ANEMOSTAT Draftless Air Diffusers.** This applies to any system, new or installed, because ANEMOSTATS are readily applied to existing systems.

GET FULL ANEMOSTAT FACTS

Find out how ANEMOSTATS assure ideal draftless air distribution — why they cannot fail — how they can lower a system's initial and operating costs. **Write for descriptive literature today.**

ANEMOSTAT
CORPORATION OF AMERICA
Dept. F, 10 East 39th Street,
New York, N. Y.

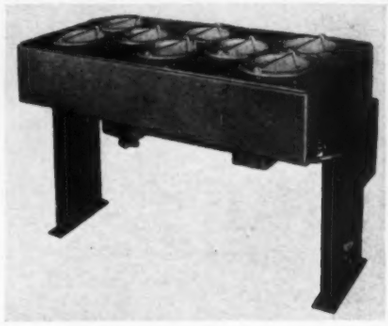
Representatives in Principal Cities

"NO AIR CONDITIONING SYSTEM IS BETTER THAN ITS AIR DISTRIBUTION"

(Continued from page 126)

Water-Jacket Glue Heater

Provides for eight 1-gal. glue pots set into a water jacket measuring 44½ in. long by 22½ in. wide. The heat is supplied by three immersion units placed in



the water jacket. Glue temperature is maintained between 140 and 150 deg. F. by thermostatic control. The water jacket is mounted on two I-beam legs, the top plate is screwed on, joints are welded. Inlet for filling the water jacket and drain-out cock are provided. The glue pots are made of galvanized cast iron. Box at one end houses the adjustable thermostat and unit terminals where a BX or conduit connection may be made. Available in various numbers and capacities of pots. Vulcan Electric Co., 600 Broad St., Lynn, Mass.

Tool Steel

A medium carbon manganese-molybdenum steel known as 773 Tool Steel features toughness and is thus suited for use in tools, dies, punches, cutting tools, chisels and applications where toughness in thin sections is required such as in step-down dies, spatulas, putty knives. A ¼-in. section in the hardened and drawn condition will take a permanent set without cracking or bending, it is said. Jessop Steel Co., 527 Green St., Washington, Pa.

Portable Hoist

Pul-Lift portable hoist has a capacity of 4½ tons, is light-weight for portability. The roller chain used is said to have an ultimate strength nearly five times the rated capacity of the hoist. The Yale safety hook opens slowly in case of severe overload and gives visual warning of danger. The hoist can be used for both pulling and lifting jobs and has a ratchet handle with universal action for operation in close quarters and tight out-of-the-way places. A self-actuated load brake reduces possibility of flying handle. Braking increases in proportion to load increase. The Yale & Towne Mfg. Co., Philadelphia Division, Philadelphia.

Dust Collector

Self-contained all-metal dust collector for removing dust and other abrasive particles from the air can be used with grinders or buffers with wheels up to 18 in. diameter, 3 in. face. Suction fan and

Designed, built and tested as a *Gearmotor*

WESTINGHOUSE DOUBLE-REDUCTION GEARMOTOR
Building both gears and electric drive in its own plants enables Westinghouse to furnish gearmotors that will handle full motor torque.
POSITIVE SPLASH LUBRICATION—assures trouble-free operation of drive.
SPLIT CASING—gives easy access to rotating parts.
SLOW SPEED SHAFT—delivers exact hp and speed required.
COMPACT MOUNTING—readily installed in small space.
BALL BEARINGS—cut friction losses to minimum.

In the design and construction of Westinghouse Gearmotors, Westinghouse engineers do not consider the reduction gears and the electric drive as separate units. A Westinghouse Gearmotor is designed, built and tested as a complete slow speed drive —a drive in which all parts are matched to provide maximum performance. By building its own gears Westinghouse gives the geared drive exactly the characteristics necessary to get the highest efficiency possible from the complete unit.

GEARMOTORS GIVE THE ADVANTAGE OF HIGH SPEED MOTOR EFFICIENCY & POWER FACTOR

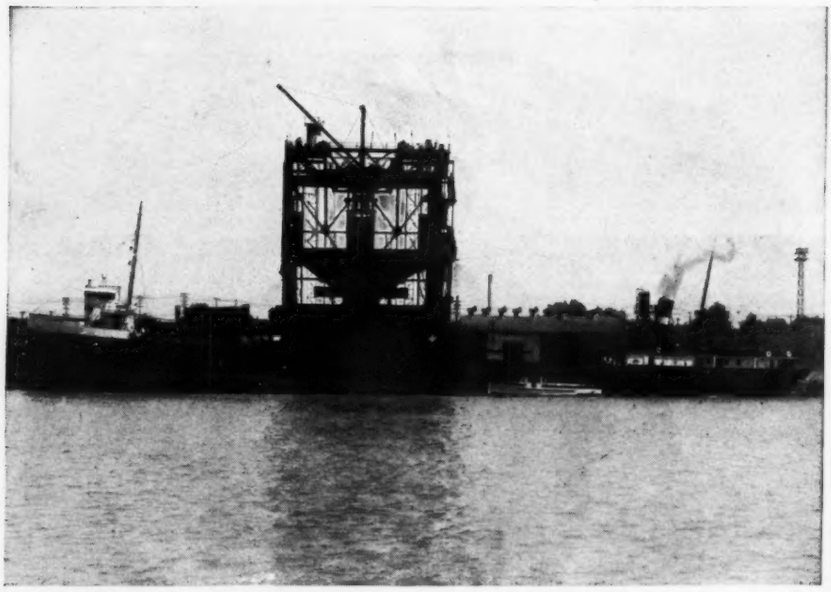
Another advantage for the user is the fact that Westinghouse Gears are made of heat-treated, forged steel, cut by the hobbing process—the most accurate method of gear cutting yet devised. This assures quiet operation and the ability of the reduction gears to transmit the full torque of the motor under load and to withstand the shocks of severe service.

For complete information on how you can cut operating costs for your slow speed drive requirements, write or call Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa.

J-07180

Westinghouse

GEARED DRIVES



38 million tons of coal loaded in six years —without a hitch —with LUBRI-ZOL

● Lubri-Zol industrial lubricants form an important contribution to capacity operation of the two big A & B docks on the Maumee River at Toledo. Before Lubri-Zol—occasional hot bearings interfered with continuous full capacity runs—causing lost time, increased costs.

After Lubri-Zol—not a single case of trouble with Lubri-Zol lubricated bearings in the last six years. The machinery is huge and the operation fast—using Lubri-Zol Extreme Pressure Oil for the 900 H.P. electric equipment, aluminum grease for the dock machinery bearings and slides—a full car of coal is picked up, turned over, dumped and set back onto the track at the rate of almost a car a minute.

Performance like this dramatically shows the day-to-day savings which Lubri-Zol makes possible in a thousand places. A full line of Lubri-Zol oils and greases are specially processed for the extra high film strength and lubricating ability necessary to obtain maximum performance from material handling equipment, production machinery, machine tools, and diesel power plants.

Our staff of industrially trained oil engineers will appreciate the opportunity to work with you on the toughest lubrication job you have—object—lower costs, increased production. Write today to The Lubri-Zol Corporation, Cleveland, Ohio.

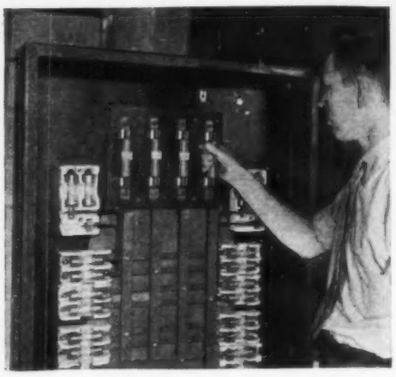
LUBRI REG. U.S. PAT. OFF. ZOL

THE LUBRI-ZOL CORPORATION
CLEVELAND, OHIO

motor are located in the top of the cabinet and operate in clean air. Model 500 Utility Motor-in-Head Grinder has a pushbutton starter with overload protection, ball bearings enclosed in dust-tight housings, enclosed adjustable wheel guards, dustproof anti-friction bearings, tool tray, and lift-out water pot. The United States Electrical Tool Co., 2482 West 6th St., Cincinnati.

Renewable Cartridge Fuse

Absence of metal end ferrules makes it possible to insert and remove Solar fuses without the use of fuse pullers. Tough



casing of hard fiber is used to eliminate possibility of shock and render removal of fuses shock-proof. Consists of two main parts and a renewable link. Warren Lamp Co., Warren, Pa.

Safety Belt Tail Line

Belt anchor is said to provide additional freedom-of-action for the man on the job. features a light flexible aircraft-type cable $\frac{3}{16}$ in. diameter, drop-forged steel snaps at either end swaged on to provide a joint between snap and cable of strength equal to the cable itself, it is said. The cable is available in any desired length and may be furnished with a covering for firm grasp and resistance to oil, weathering, and abrasive action. It attaches to the D-ring of the worker's belt. Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh.

Lift Trucks

Models GX and FX trucks have a full lift of 3 in. accomplished with four full or thirteen short strokes. Both have angle lift and spring handle holdup. Four ball-bearing wheels are standard equipment. The front wheels are widespread for stability. Sizes range in length from 30-144 in. in multiples of 6 in.; widths of 18 and 24 inches; wheels 6, 7, 9, or 11 in. diameter. Model GX has a capacity of 2,500 lb., Model FX of 3,500 pounds. Barrett-Cravens Co., 3250 West 30th St., Chicago.

Photoelectric Relay

Operates at speeds up to 150 interruptions per minute and at a minimum of 40 foot-candles at the phototube with not more than 15 foot-candles of extraneous

SURE DRYING

Concrete Paint Speeds Construction

YOU CAN APPLY PAINT MADE WITH PARLON SOON AFTER YOU KNOCK OFF THE FORMS. DRIES RAPIDLY ON NEW OR OLD CONCRETE. RESISTS ALKALIES THAT DESTROY OTHER PAINTS

THERE'S a remarkable new paint made with a Parlon base. It dries faster and lasts longer than most other paints. You can apply it almost as soon as you can walk on concrete. It gives real protection, because it resists the chemical action set up by moisture and alkalies that is so destructive to other paints on concrete, plaster, stucco, asbestos-cement board, and similar alkaline surfaces.

Whether you're painting new or old construction you'll save valuable time with Parlon paint. You'll repaint less often, thus reducing upkeep and time-out for men and equipment.

HOW YOU CAN GET PARLON PAINT

Now that speed is so important in industrial expansion and production, Parlon paints are called for on scores of jobs. You can easily get this new speed-up paint.

Progressive paint manufacturers throughout the country are rapidly adding Parlon paint to their lines. You can probably buy it from your regular supplier. If he is not yet ready to give this service, send us his name and we'll be glad to help you. Mail the coupon for complete information about the new paint that really protects and decorates alkaline surfaces.

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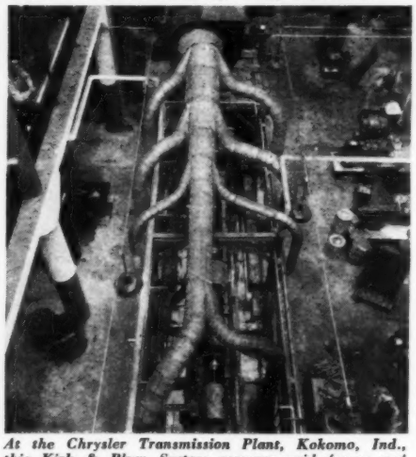
Kirk & Blum Dust Control Systems are designed and engineered to meet individual plant requirements. Exclusive features make possible a greater amount of suction with less power, assuring economical operation. Installed under a written performance guarantee.

Kirk & Blum Dust Control System at large Detroit Factory. Air from "Cyclones" is passed through filters, then returned to building, saving much heat.

FUME REMOVAL SYSTEMS

Kirk & Blum Fume Exhaust Systems remove injurious fumes and vapors quickly, efficiently, economically. Protect workmen and machines, increase production, insure a better product, cut maintenance, save on insurance. Our engineers will, without obligation, make a survey of your plant and submit recommendations for effective fume removal.

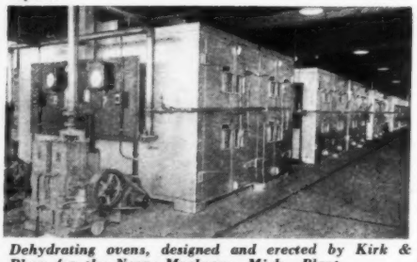


At the Chrysler Transmission Plant, Kokomo, Ind., this Kirk & Blum System removes acid fumes and vapors.

INDUSTRIAL OVENS

for Drying • Baking • Enameling

—from small box type to large continuous conveyor ovens—meet modern demands for faster production, improved finishes, lower operating costs, savings in floor space. Maximum safety is provided through use of latest safety devices. Write for interesting data and details of K & B Engineering Service.



Dehydrating ovens, designed and erected by Kirk & Blum for the Norge Muskegon, Mich., Plant.

SHEET METAL FABRICATION

Whatever your requirements in sheet metal, we are equipped to manufacture the desired unit to your complete satisfaction. Stainless, Monel metal, aluminum and other metal alloy fabrication. We specialize in welded machine bases, pedestals and frames; lathes pans; gear and belt guards; sheet steel and plate work. Let us quote on your requirements.

Interior view, showing Kirk & Blum fabricated Sheet Metal Units. The Kirk & Blum fully-equipped plant has over two-acres of floor space.

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featuring Kirk & Blum installations throughout the nation.

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Mailed to interested executives on request.

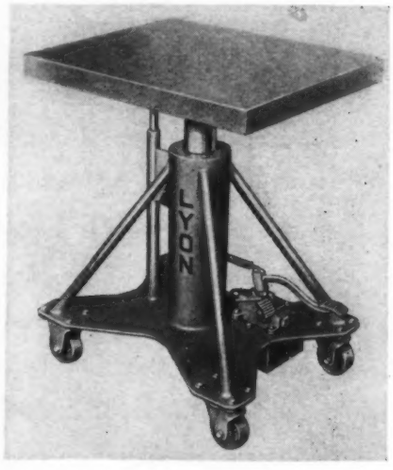
THE KIRK & BLUM MANUFACTURING CO.

2853 Spring Grove Avenue • CINCINNATI, OHIO

light present. Applications include counting, sorting, weighing, measuring, controlling, signaling, inspecting, and regulating. Relay has a controlled contact rating of 10 amp. at 115 volts a.c. with two normally open and two normally closed contacts. Coil is energized when light at phototube is reduced below 30 foot-candles. Mounting: Wall mounting on concealed rigid conduit, exposed rigid conduit, or with flexible conduit or open wiring; bench or table mounting on rigid conduit, or with flexible conduit or open wiring; by other accepted methods. Removable bracket can be secured to supporting surface and conduit, if used, before mounting the relay. General Electric Co., Schenectady, N. Y.

Hydraulic Elevating Table

Moves dies in and out of presses or storage spaces, lifts or supports overhanging work on drill presses or other machines, transfers heavy materials or parts from one machine or work bench to another machine or bench, provides an adjustable and portable work table or bench. Features claimed: Foot pedal elevates and lowers the table, table is guided so that it cannot swivel as related to the base, hydraulic grease fittings in all wheels and forks of swivel casters provide lubrication. Standard size has 2,000 lb. capacity, table measures 24x30 in., base is same size, lowered height is 28 in., elevated height is 42 in., casters are two ball-bearing swivel and two stationary, wheels are 4 in. diameter with roller bearings, weight is 350 pounds. Lyon Iron Works, Greene, N. Y.



Metal-Cutting Alloy

Star J-Metal cobalt-chromium tungsten metal-cutting alloy is recommended for all machining operations now being performed with the original J-Metal tools—on cast iron, semi-steel, steel and other materials. The new tools can be operated under the same conditions as the original grade and are ground with the same wheels at the same wheel speeds and feeds. But, it is said, tool life between grinds is longer and in some cases higher cutting speeds and feeds are possible. It is now available in manufacturers' standard tool bit sizes, squares and flats, standard and

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FORMULA SBS-11. Each day more and more industrial plants are furnishing their employees Formula SBS-11, the modern industrial skin cleanser which cleans safely, rapidly, thoroughly. Formula SBS-11 helps prevent skin irritation, dermatitis, infection and chapping—leaves hands smooth and soft. SBS-11 costs less than 1c per worker per week. Write today for a free trial supply. Please state number of employees.

FORMULA SBS-15 provides the same benefits as Formula SBS-11 but is intended for factory workers who do not encounter heavy grease and grime. This product is chemically the same as Formula SBS-11 but is finer in texture.

FORMULA SBS-20, an efficient office soap penetrates dirt safely and cleanses quickly. Leaves skin soft, smooth and refreshed. Contains only such ingredients as have proved beneficial to the skin. Compounded from highest quality vegetable oil soaps. Highly praised by both men and women workers wherever it has been used. Write today for complete facts and generous free trial supply.

DISPENSERS. For economically dispensing Formula SBS-11, SBS-15 or SBS-20. Highly polished chromium plate over nickel on solid brass base. Easy to clean. Ruggedly built. Fixed or adjustable discharge. Theft-proof lid. Large opening for easy refilling. Heavy, sturdy mounting brackets.

SLIP-NOT PREVENTS FALLS. Spread on greasy, oily, wet or slippery floors or stairs this amazing new compound, covers the slippery substance, makes hazardous areas slip-proof. Costs less than 1c to protect 50 square feet with SLIP-NOT. Available in 1 lb. sifter-top cans or in bulk. Write for free trial supply.

SLIP-NOT SPREADER No. 3318 saves time, insures efficient distribution of SLIP-NOT.

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...the job done
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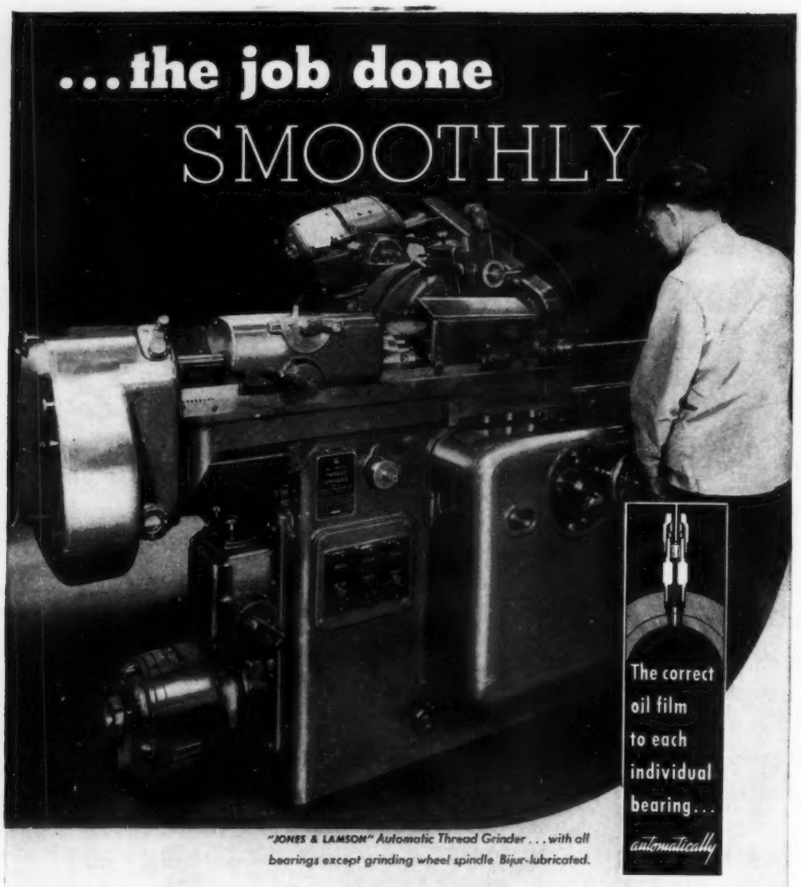

"JONES & LAMSON" Automatic Thread Grinder . . . with all bearings except grinding wheel spindle Bijur-lubricated.

● No time is lost from productive work . . . a BIJUR-equipped machine oils itself, while running! Metered oil-feed—the correct oil-film needed by each individual bearing—is supplied automatically. The efficiency of operator and machine is raised . . . precision standards are held . . . maintenance is reduced to a minimum . . . production stepped up!

BIJUR LUBRICATING CORPORATION, LONG ISLAND CITY, N. Y.

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MAKE SURE THOSE
NEW MACHINES YOU BUY
ARE AUTOMATICALLY
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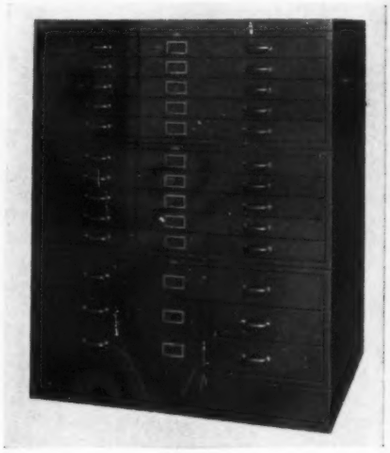
special blade designs and sizes; in the form of standard welded-tip tools and in special tool designs for grooving, cutting off, counterboring, spot facing, form cutting, core drilling. Haynes Stellite Co., Kokomo, Ind.

Blueprint Cabinets

The three and five-drawer units feature smooth coasting-drawer operation. Six rollers support each drawer so that it slides out easily, does not sag, and does not rebound when pushed back, it is said. A stop prevents accidental withdrawal but may be disengaged for drawer removal. The cabinets come in four sizes to hold blueprints, drawings, maps measuring from 24x18 in. to 48x36 inches. Both the three and five-drawer units are 16¾ in. high; drawers of the former are 3⅛ in. deep, of the latter 2 in. deep; closed base is 6 in. high. Legs 6 in. high are also available. A separate top is 1⅝ in. high. All-Steel-Equip. Co., Inc., Aurora, Ill.



Fluorescent Lighting Unit

Miralume F-230 designed to incorporate the 100-watt white fluorescent lamps comes complete with two lamps each 5 ft. long to furnish a more powerful light source for industrial applications where higher total lumens are required from each fixture. It is wired completely; comes with starters, special Mirastat starter, Dua-Lamp auxiliary; is corrected for stroboscopic effect. Total wattage including lamps and auxiliary is 230 watts. Units are available for 110-125 volts, 60-cycle a.c. Hygrade Sylvania Corp., Salem, Mass.

Dehydrator

An automatically operated self-contained dehydrator embodying the principle of removing moisture from air by adsorption without resorting to low-temperature cooling employs silica gel as the dehydrating substance. The gel is said to be capable of adsorbing up to 40 percent of its weight in moisture. Entirely automatic in operation, the unit consists essentially of a rotating cylindrical wire-screen drum containing silica gel, two fans and fan motor, drive mechanism to rotate the drum, air heater for activating the silica gel, and housing. The adsorption and activation

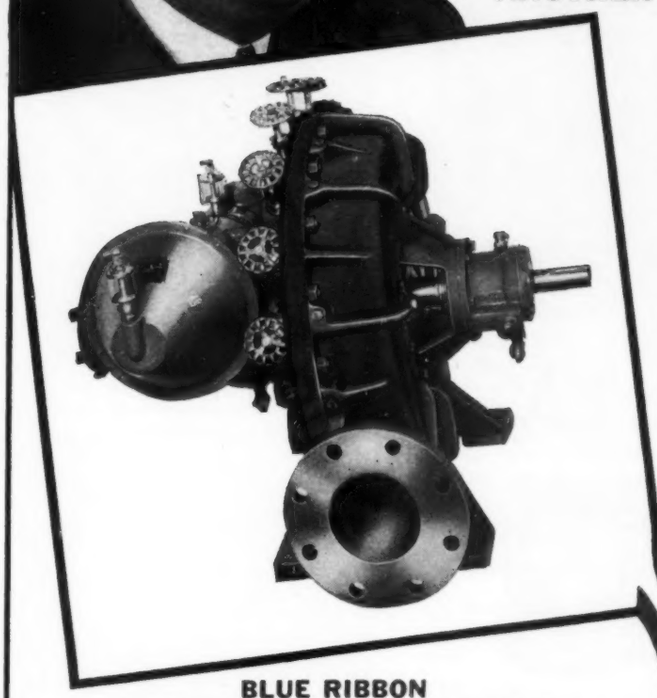
"I CAN'T TELL WHETHER IT'S RUNNING UNLESS I PLACE MY HAND ON THE SHAFT"

Says **PUBLIC UTILITY EXECUTIVE, OF COPPUS-TURBINE-EQUIPPED PUMP**

ANOTHER COPPUS BLUE RIBBON PRODUCT

A prominent pump manufacturer says that "numerous unsolicited testimonial letters, have come in from customers, praising the performance of this machine," a pump equipped with the Coppus Blue Ribbon Steam Turbine. One of the testimonials received by the pump manufacturer, is quoted in the caption above.

Such sweet-running, trouble-free performance is one of the main reasons why men like pumps to be equipped with Blue Ribbon Steam Turbines. The other reason is the economy of buying turbine equipment sized right for small jobs.



BLUE RIBBON INDICATES THESE ADVANTAGES

On all Coppus Products, the Blue Ribbon is a seal of precision and careful inspection. In the case of Steam Turbines, it means:

(1) Precision workmanship — controlled by Johansson size blocks
(2) Encased governor — slow speed, leverless
(3) Separate safety trip—pilot-operated, leverless
(4) Partial load economy — by individual nozzle control
(5) Dynamometer tested — before shipment

87% repeat orders, out of our 1939 Steam Turbine business. Operated by steam, gas, or air. Built-in speed reducers available. Vertical or horizontal types.

Write for full facts in free bulletin 135-9

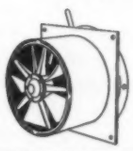
H. P. not E. P.* for Small H. P. Jobs

*Elephant Power — a large-size turbine for a job a small-size Coppus could handle. Save investment cost with a Coppus Turbine sized close to your needs.

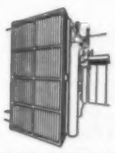
Coppus Engineering Corp., 209 Park Avenue, Worcester, Massachusetts. Sales offices in THOMAS' REGISTER. See SWEET'S CATALOG for other "Blue Ribbon" products—air filters, gas burners, blowers, ventilators, fans.

COPPUS BLUE RIBBON PRODUCTS

Designed for your Industry
Engineered for You



COPPUS-DENNIS FANMIX GAS BURNER. New method of mixing gas and air insures perfect gas-air ratio—instant, complete combustion. Bulletin 410-2.



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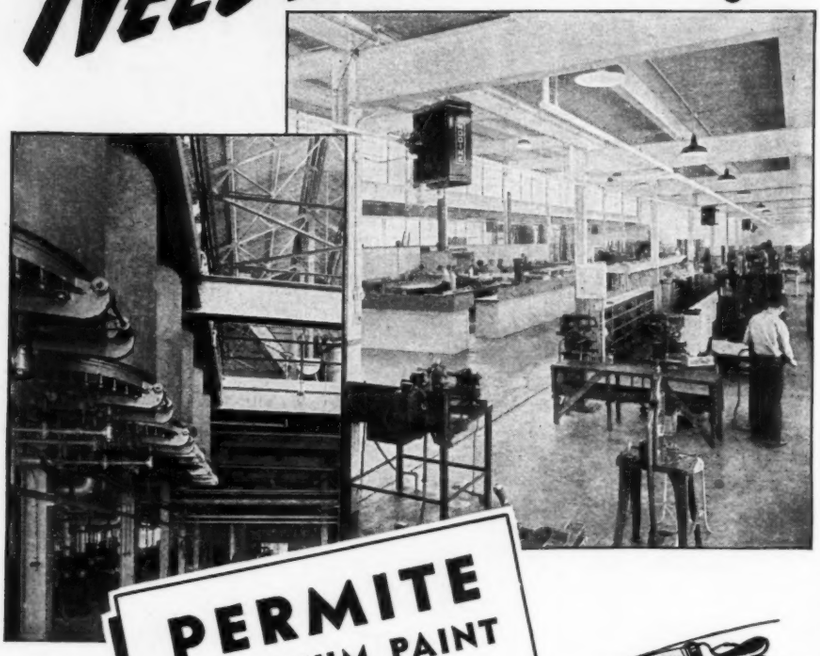

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ALUMINUM PAINT
No. 1000
is Recommended!

PERMITE Aluminum Paint No. 1000 is particularly suited for painting interior walls and ceilings of metal and wood --- reflects 75% of the light directed upon the painted surface. Easy to keep clean. Dirt and grime do not readily adhere to the smooth chrome-like Permite aluminum finish.

Wet walls? No need for them to prevent a good painting job. Just use Permite *Wet Surface* Aluminum Paint.

For practically every specific painting requirement there is a correct type of Permite Aluminum Paint. Whether *your plant* needs a wet surface aluminum paint, an aluminum paint for better protection and illumination, an aluminum paint for machinery and equipment, or an aluminum paint specifically for outdoor use, there is a Permite paint made to solve your problems. It's ready-mixed — ready for instant use. Saves time, saves money, saves waste. Write for complete, illustrated Aluminum Paint Manual — today.

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PERMITE *Ready-Mixed*
ALUMINUM PAINTS

processes go on in a continuous cycle under control of a hydrostat. Finds use in the manufacture of chemicals, drugs, candy, electrical products, explosives, films, plastics, steel products. Available in four sizes (approximately 460-3, 150 cu.ft. of air per min.), it utilizes gas or steam heat for actuation. Carrier Corp., Syracuse, N. Y.

Permanent Magnet Filter

The Ferro Filter magnetically extracts coarse and small iron particles as fine as 1/25.000 in. diameter, it is said, from such liquids as lube oil, liquid foods. It consists of a stack of soft iron screens magnetized by two permanent magnets and is enclosed in a cylindrical casing through which the oil flows. Triangular mesh openings measure ⅛ inch. There are no moving parts, no electrical connections, no filter elements. The filter screws into a pipe line and comes in two models: P3Q has 1-in. pipe connection, lubricating oil capacity of 20 U.S. gal. per min.; P2Q has ¾ in. pipe connection, lubricating oil capacity of 10 U.S. gal. per minute. Both have a working pressure of 100 lb. per sq. inch. S. G. Frantz Co., Inc., 161 Grand St., New York.

Protective Lighting

Designed especially for industrial plants where tower truck maintenance equipment is not available. Assembly consists of a high-intensity luminaire mounted on a tapered steel Monotube pole. The luminaire is equipped with a disconnecting orientating cutout which permits it to be lowered for relamping, cleaning. The Union Metal Mfg. Co., Canton, Ohio.

Safety Boot

The Par-Grip safety boot features a sole that is made in one flat piece from toe to heel to increase traction area and is molded in a diamond-shaped grid pattern forming tiny "suction cups" to grip wet floors. For use in plants where floors are coated with oil, grease, and fat, the boot is also made with a Neoprene-treated vamp and special compound Neoprene sole for skid protection, toe protection. The boot can be worn both outdoors and in. The safety-sole boot is available in knee-boot or ankle-

boot models, black or white with the Armorplate steel toe box built in for toe protection and with a leather insole to prevent burn often caused by all-day use of rubber footwear. An all-Neoprene boot without safety construction is made for use where floors are extremely greasy and oily. Lehigh Safety Shoe Co., Allentown, Pa.

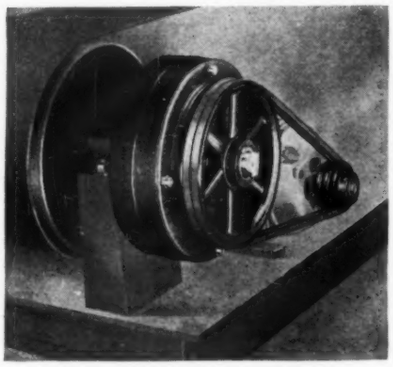
Unit Heaters

Cabinet-type heater is complete with fans, motors, and heating surface enclosed. Piping and electric connections are made within the cabinet. It is particularly adaptable to spot heating in vestibules, stairways, and halls. Eight sizes available in wall, floor, and suspended types.

The radial unit heater designed to do the work of two or more single-direction heaters is made in suspension style and is encased in a semi-circular steel casing. It is made in seven cabinet sizes and in twenty-two capacities from 41,690-476,000 B.t.u. per hour. McQuay, Inc., 1620 Broadway, N.E., Minneapolis.

Reduction Drive

Speed reducer consists of two major elements—a helical-gear reduction unit which mounts directly on the shaft of the driven machine and a standard belt drive between



the motor and input shaft of the reduction unit. Unit has a standard fixed ratio of 13:1, greater or lesser ratios being accomplished by the primary belt drive. Five units cover applications from ½ to 30 horsepower, 11-215 r.p.m. Special units can be assembled for speeds lower than 11 r.p.m. The American Pulley Co., 4200 Wissahickon Ave., Philadelphia.

Test Stand

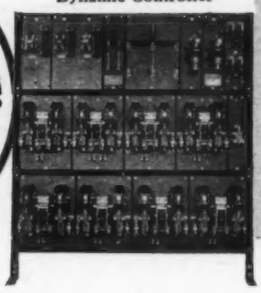
Multi-purpose variable-speed Speed-Trol test stand, specially designed for routine testing of such industrial equipment and aircraft accessories as generators, alternators and vacuum, hydraulic and fuel pumps, checks and determines behavior at normal and over-speeds. Standard units are furnished with 5-hp. motors and provide infinite speeds from 1,000-5,000 r.p.m. without aid of gears on output shaft, it is said. Units of other horsepowers and speeds are available. Features: totally enclosed mechanism, handwheel for speed adjust-

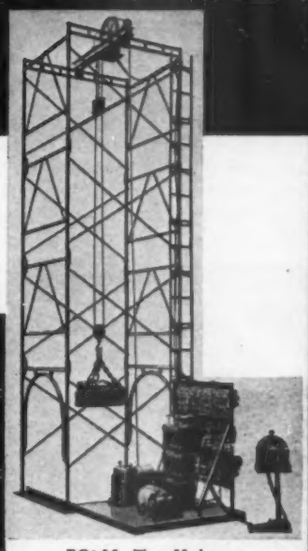
THEY *Flew* TO CLEVELAND FOR PROOF

AND THE EC&M TEST-HOIST FURNISHED IT!

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

Typical EC&M A-c Dynamic Controller





EC&M Test-Hoist at Cleveland, Ohio

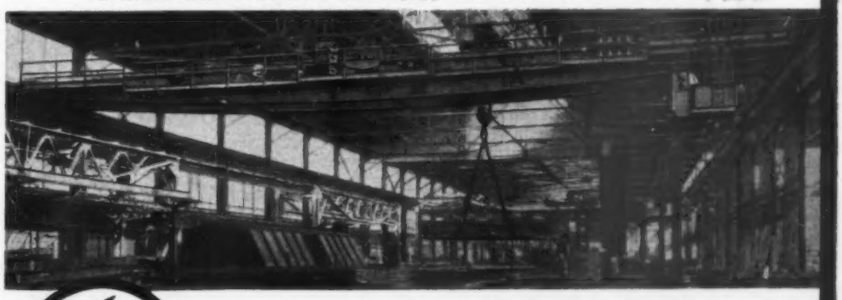
WHEN buying cranes for their army-tank plant, the executives of a prominent mid-western company were faced with the problem of securing the most efficient crane controls.

Hearing of the new EC&M all A-c Magnetic Crane Control, they wanted to see it in action. So they flew to Cleveland and witnessed a demonstration on the EC&M Test-Hoist.

Here they saw the first actual improvement in control for alternating current hoists, this EC&M all A-c Magnetic Crane Control providing three important advantages: (1) Elimination of the costly-to-maintain mechanical load-brake; (2) Ability to spot loads with extreme accuracy; (3) Smooth operation without danger of overspeeding. *And they specified these controls for four cranes.*

For existing cranes or new cranes of the overhead, whirler, portal and other types, this "EC&M Frequency Relay Magnetic Control" offers a substantial improvement in crane performance. Ask for Folder 930-A. The Electric Controller & Mfg. Co., Cleveland, O.

Overhead Crane in Southern Plant equipped with the new EC&M A-c Control



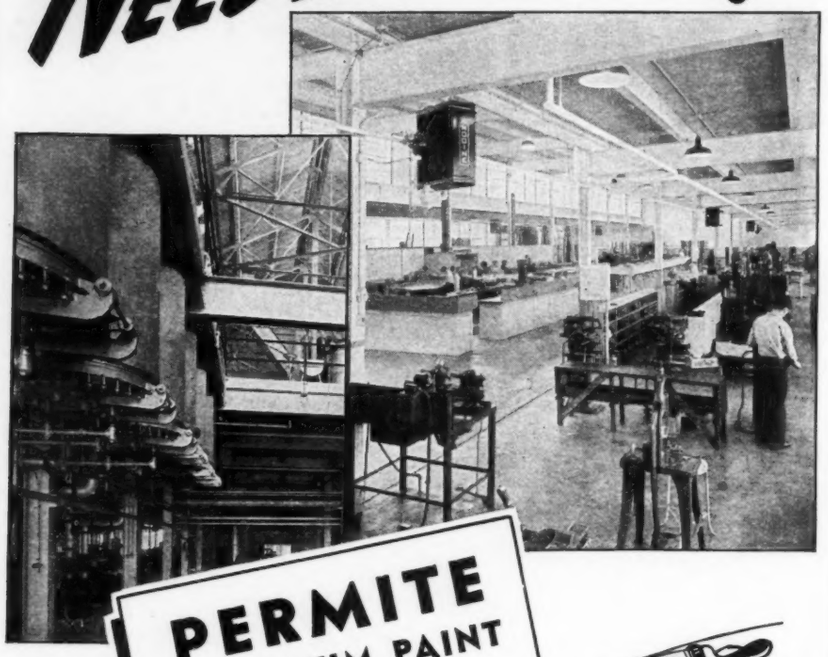
Please send A-c Crane Folder 930-A

Name .....

Address .....

MOTOR CONTROLS • BRAKES • LIMIT STOPS • MAGNETS

NEED MORE LIGHT?



PERMITE ALUMINUM PAINT No. 1000 is recommended!

PERMITE Aluminum Paint No. 1000 is particularly suited for painting interior walls and ceilings of metal and wood --- reflects 75% of the light directed upon the painted surface. Easy to keep clean. Dirt and grime do not readily adhere to the smooth chrome-like Permite aluminum finish.

Wet walls? No need for them to prevent a good painting job. Just use Permite *Wet Surface* Aluminum Paint.

For practically every specific painting requirement there is a correct type of Permite Aluminum Paint. Whether *your plant* needs a wet surface aluminum paint, an aluminum paint for better protection and illumination, an aluminum paint for machinery and equipment, or an aluminum paint specifically for outdoor use, there is a Permite paint made to solve your problems. It's ready-mixed --- ready for instant use. Saves time, saves money, saves waste. Write for complete, illustrated Aluminum Paint Manual --- today.

ALUMINUM INDUSTRIES, Inc., CINCINNATI, OHIO

Distributors in Principal Cities

PERMITE *Ready-Mixed*

ALUMINUM PAINTS

processes go on in a continuous cycle under control of a hydrostat. Finds use in the manufacture of chemicals, drugs, candy, electrical products, explosives, films, plastics, steel products. Available in four sizes (approximately 460-3, 150 cu.ft. of air per min.), it utilizes gas or steam heat for actuation. Carrier Corp., Syracuse, N. Y.

Permanent Magnet Filter

The Ferro Filter magnetically extracts coarse and small iron particles as fine as 1/25.000 in. diameter, it is said, from such liquids as lube oil, liquid foods. It consists of a stack of soft iron screens magnetized by two permanent magnets and is enclosed in a cylindrical casing through which the oil flows. Triangular mesh openings measure ⅛ inch. There are no moving parts, no electrical connections, no filter elements. The filter screws into a pipe line and comes in two models: P3Q has 1-in. pipe connection, lubricating oil capacity of 20 U.S. gal. per min.; P2Q has ¾ in. pipe connection, lubricating oil capacity of 10 U.S. gal. per minute. Both have a working pressure of 100 lb. per sq. inch. S. G. Frantz Co., Inc., 161 Grand St., New York.

Protective Lighting

Designed especially for industrial plants where tower truck maintenance equipment is not available. Assembly consists of a high-intensity luminaire mounted on a tapered steel Monotube pole. The luminaire is equipped with a disconnecting orientating cutout which permits it to be lowered for relamping, cleaning. The Union Metal Mfg. Co., Canton, Ohio.

Safety Boot

The Par-Grip safety boot features a sole that is made in one flat piece from toe to heel to increase traction area and is molded in a diamond-shaped grid pattern forming tiny "suction cups" to grip wet floors. For use in plants where floors are coated with oil, grease, and fat, the boot is also made with a Neoprene-treated vamp and special compound Neoprene sole for skid protection, toe protection. The boot can be worn both outdoors and in. The safety-sole boot is available in knee-boot or ankle-

boot models, black or white with the Armorplate steel toe box built in for toe protection and with a leather insole to prevent burn often caused by all-day use of rubber footwear. An all-Neoprene boot without safety construction is made for use where floors are extremely greasy and oily. Lehigh Safety Shoe Co., Allentown, Pa.

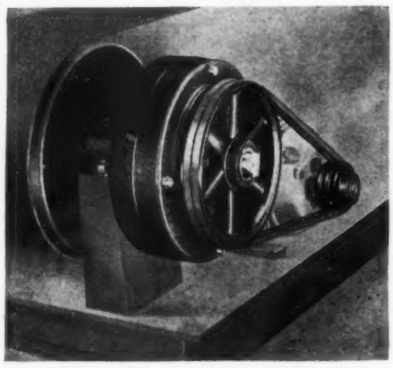
Unit Heaters

Cabinet-type heater is complete with fans, motors, and heating surface enclosed. Piping and electric connections are made within the cabinet. It is particularly adaptable to spot heating in vestibules, stairways, and halls. Eight sizes available in wall, floor, and suspended types.

The radial unit heater designed to do the work of two or more single-direction heaters is made in suspension style and is encased in a semi-circular steel casing. It is made in seven cabinet sizes and in twenty-two capacities from 41,690-476,000 B.t.u. per hour. McQuay, Inc., 1620 Broadway, N.E., Minneapolis.

Reduction Drive

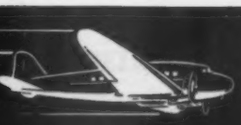
Speed reducer consists of two major elements—a helical-gear reduction unit which mounts directly on the shaft of the driven machine and a standard belt drive between



the motor and input shaft of the reduction unit. Unit has a standard fixed ratio of 13:1, greater or lesser ratios being accomplished by the primary belt drive. Five units cover applications from ½ to 30 horsepower, 11-215 r.p.m. Special units can be assembled for speeds lower than 11 r.p.m. The American Pulley Co., 4200 Wissahickon Ave., Philadelphia.

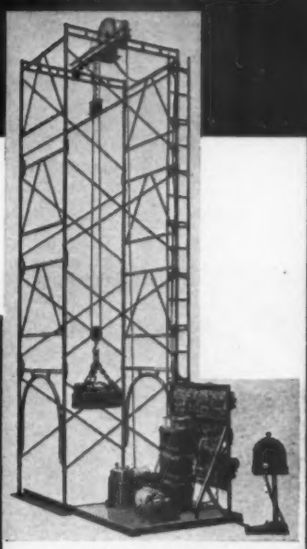
Test Stand

Multi-purpose variable-speed Speed-Trol test stand, specially designed for routine testing of such industrial equipment and aircraft accessories as generators, alternators and vacuum, hydraulic and fuel pumps, checks and determines behavior at normal and over-speeds. Standard units are furnished with 5-hp. motors and provide infinite speeds from 1,000-5,000 r.p.m. without aid of gears on output shaft, it is said. Units of other horsepowers and speeds are available. Features: totally enclosed mechanism, handwheel for speed adjust-



THEY *Flew* TO CLEVELAND FOR PROOF

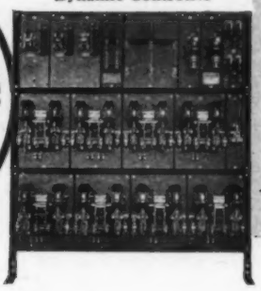
AND THE EC&M TEST-HOIST FURNISHED IT!



EC&M Test-Hoist at Cleveland, Ohio

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

Typical EC&M A-c Dynamic Controller



WHEN buying cranes for their army-tank plant, the executives of a prominent mid-western company were faced with the problem of securing the most efficient crane controls.

Hearing of the new EC&M all A-c Magnetic Crane Control, they wanted to see it in action. So they flew to Cleveland and witnessed a demonstration on the EC&M Test-Hoist.

Here they saw the first actual improvement in control for alternating current hoists, this EC&M all A-c Magnetic Crane Control providing three important advantages: (1) Elimination of the costly-to-maintain mechanical load-brake; (2) Ability to spot loads with extreme accuracy; (3) Smooth operation without danger of overspeeding. *And they specified these controls for four cranes.*

For existing cranes or new cranes of the overhead, whirler, portal and other types, this "EC&M Frequency Relay Magnetic Control" offers a substantial improvement in crane performance. Ask for Folder 930-A. The Electric Controller & Mfg. Co., Cleveland, O.

Overhead Crane in Southern Plant equipped with the new EC&M A-c Control

Please send A-c Crane Folder 930-A

Name .....

Address .....

MOTOR CONTROLS • BRAKES • LIMIT STOPS • MAGNETS

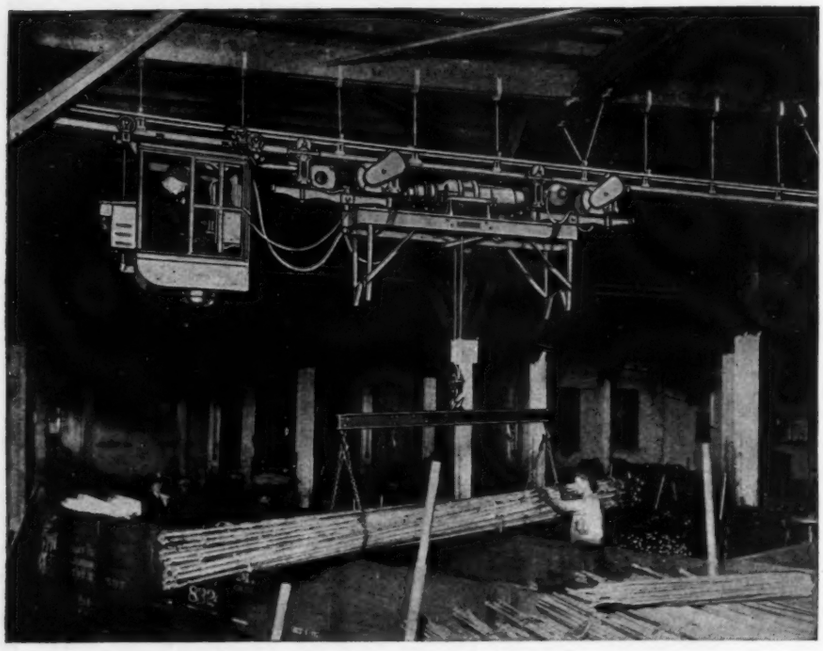
UPSIDE DOWN RAILROAD
ELIMINATES PRODUCTION BOTTLENECKS

Think of a railroad turned upside down so that instead of running on terra firma, it carries its loads on an extensive track system overhead! That in effect is what a Cleveland Tramrail System is.

Complete with rail, switches, carriers, tractors, cranes, and hoists, Cleveland Tramrail is said to simplify and cut the cost of materials handling.

Being extremely flexible, Cleveland Tramrail is readily adaptable to practically any type building whether old or new, for every kind of materials handling. Systems may be as simple or extensive as required—from simple hand-operated ones to completely electrified plant-wide systems. Many installations are completely automatic; delivering loads, unloading and returning automatically without operator accompanying.

Many suggestions for eliminating bottlenecks and aiding production by overhead materials handling methods are given in a profusely illustrated booklet No. 2004-AA offered by the Cleveland Tramrail Division, The Cleveland Crane & Engineering Company, 1187 East 283rd Street, Wickliffe, Ohio.



SAVES HOURS OF HANDLING TIME
. . . every day!

With a Cleveland Tramrail system (as illustrated) bar steel and pipe can be removed quickly and easily from railroad cars and placed directly into stock. The same system delivers materials from stock to point of work in fast time with no rehandling.

Cleveland Tramrail electrically-driven cab-controlled systems greatly increase the amount of materials that can be handled with the same stock men. In busy plants they save many hours of handling time every day.

It will pay you to investigate Cleveland Tramrail.

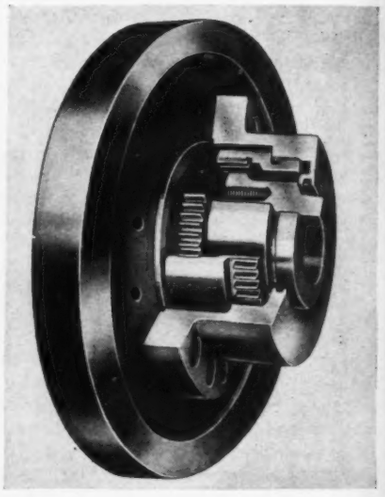
CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO
1187 East 283rd Street Wickliffe, Ohio

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT
Other products: CLEVELAND CRANES and STEELWELD MACHINERY

ment, pushbutton with magnetic switch and overload protection, enclosed gear-driven magneto, standardized mounting dimension bracket and coupling. Sterling Electric Motors, Inc., Telegraphic Road at Atlantic Boulevard, Los Angeles.

Flexible Coupling

The Manger coupling is said to save space and secure flexibility in connecting a shaft directly to a flywheel, brake drum, or flange and to eliminate the use of a dummy, pilot, or stub shaft. It is also applicable in connecting two free-ended



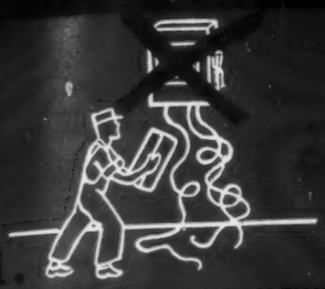
shafts in combination with a solid flanged half coupling. By coupling two units to a single driver with Manger couplings it is possible to operate one unit by unbolting the coupling and drawing back the outer sleeve on the unit not used. In connecting shafts of different diameters the coupling is mounted on the smaller shaft and bolted to a rigid flanged half coupling on the larger shaft. Compensation for misalignment is provided for. Farrel-Birmingham Co., Inc., Ansonia, Conn.

Non-Spark Sand Blast Hose

Designed to remove danger of explosions, fires, or other hazards that might be caused by static generated within the hose, Condor sand blast hose is constructed with a special non-spark inner tube and cover. A specially compounded rubber is used to prevent the development of static electricity generated by friction of materials abrading against the inside or cover of the hose. It is used for cleaning and preparing castings, removing dust and dirt from metals, and like work. Extra-heavy tube is said to resist cutting action of sand or steel shot at high pressures. Four plies of heavy duck covered with abrasion-resisting black rubber are wrapped over the tube. The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J.

A.C. Electric Welders

Line of single-phase 60-cycle welders can be used on one phase of a 2 or 3-phase supply line. Coils are wound with double-



1.

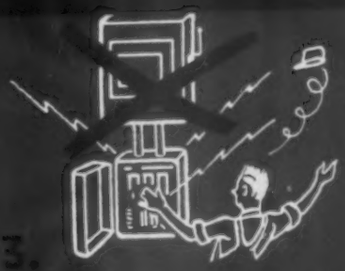
WASTE OF INSTALLATION TIME

With the combination starter you have only one piece of equipment to install and wire.

2.

SACRIFICE OF VALUABLE SPACE

The combination starter takes less space than separate devices require. It can be mounted right on the machine.



3.

DANGER FROM "HOT" PARTS

You can't touch live parts on the combination starter. The switch must be OFF before the cover can be opened.

3 THINGS YOU'LL AVOID

REMEMBER how you formerly used a different machine for every operation? Today you perform several operations on the same machine—better and at lower cost.

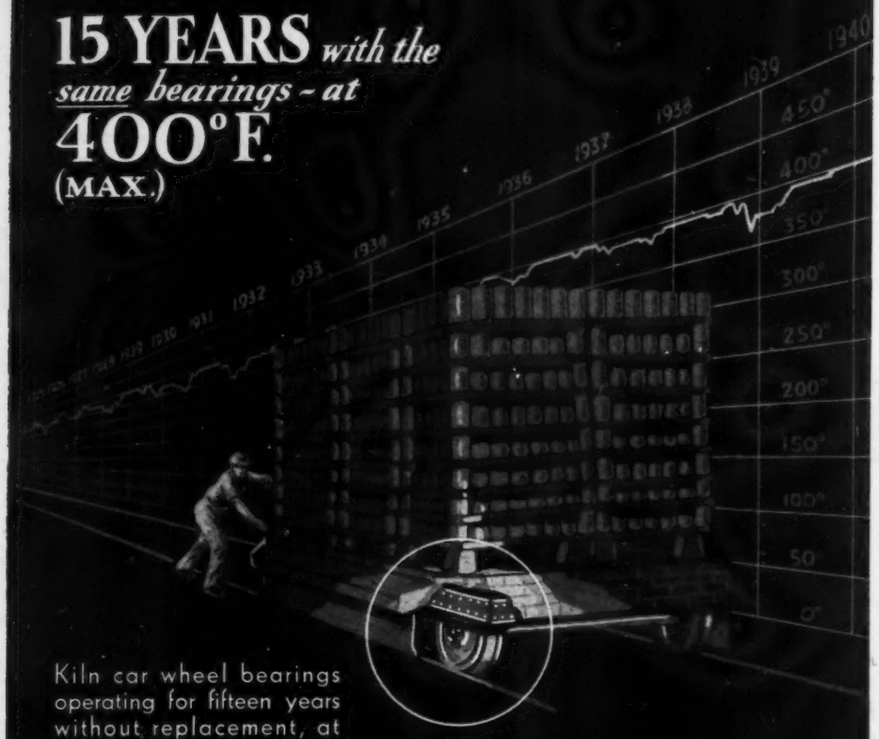
The use of modern "packaged" control is comparable. A single, compact, attractive control now performs the functions that used to require two or more devices. You buy it as a unit, install it as a unit, and benefit from a host of other important advantages.

We'd like you to have our new bulletin, GES-2456 "More for Your Control Dollar." It shows how others are money ahead because they use G-E combination starters for the motors they install and the machines they buy. Write for your copy. General Electric, Schenectady, N. Y.

with G-E COMBINATION STARTERS

GENERAL ELECTRIC

15 YEARS *with the same bearings - at* 400°F. (MAX.)



Kiln car wheel bearings operating for fifteen years without replacement, at temperatures of 400° F. has been credited to the lubricant, "dag" colloidal graphite, by a prominent ceramics manufacturer.

Oildag-Concentrated, Type 1104, was blended in proper proportion with water-white kerosine and applied to the parts at somewhat below the maximum temperature. This lubricant does not sizzle or splatter, but remains fluid long enough to get the positive lubricating film of colloidal graphite to the vital point. The carrier liquid finally evaporates, leaving only the graphite, which becomes a part of the bearing surface. The original wheel bearings are still in service.

"Dag" colloidal graphite, dispersed in various fluids, is solving high temperature lubrication problems in many industries. Ask your oil supplier about his lubricants containing colloidal graphite. A note on your letterhead will bring a working sample and Bulletin Number 130, which tells you how to use this solid lubricant for high temperatures.

dag COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

Here are a few of the many uses of colloidal graphite in industry—check any with which you may be having lubrication difficulties.

"DAG" COLLOIDAL GRAPHITE FOR:

CONVEYORS ☐	SCREW THREADS ☐
FORGING DIES ☐	STEAM CYLINDER ☐
COMPRESSORS ☐	CASTING ☐
GLASS MOLD ☐	CONDUCTIVE COATINGS ☐
ASSEMBLY AND RUN-IN ☐	IMPREGNATION ☐

Tear off this coupon and attach to your letterhead—it will bring a working sample for the uses you specify.

ACHESON COLLOIDS CORPORATION • Port Huron, Michigan

spun fiber-glass insulated magnet wire. Transformers are dehydrated under high temperature and impregnated with insulating varnish. To produce strong dense welds magnetic blow is eliminated and the arc agitates the pool of molten metal refining and improving quality of deposited metal. There are no load losses, and exciting current requirements do not increase with age but remain constant throughout life of welder, it is said. Commonwealth Electric Welder Mfg. Co., 3200-C West Oxford St., Philadelphia.

Ball-Bearing Lift Truck

Capable of handling loads up to 1,000 lb. and can be used with or without skids (made possible by a sheet metal deck on upper frame). Platform heights: 3½, 6, 7, and 9 inches. The 3½-in. height permits use in light and small industries. Available in 18-in. width and 2-in. lift. Barrett-Cravens Co., 3250 West 30th St., Chicago.

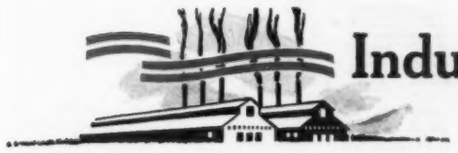
Photoelectrode System

The Protectoglo may be used to protect a luminous flame against explosion hazards (includes oil, powdered-coal, and raw-gas flames). It detects the presence of a flame by means of the light emitted when a burner is in normal operation. The heart of the system is essentially a light-

sensitive device. The response of the system to flames of different luminosity may be changed on the job by means of a sensitivity adjustment. A time lag (0-10 sec.) in the relay operation acts to prevent transient flame disturbances from causing unnecessary shutdowns. Door switch connected in series with relay coil de-energizes the relay whenever the door is opened. Swivel mounting can be screwed to a length of 1¾ in. to isolate the unit from heat of burner and furnace wall and to provide a ready means for sighting on the flame. The Brown Instrument Co., Wayne and Roberts Aves., Philadelphia.

Glue Pot

Electric water-jacket glue pot has a capacity of 3 gallons. Heat is applied by an immersion unit in the water jacket. The pot is said to come up from cold to



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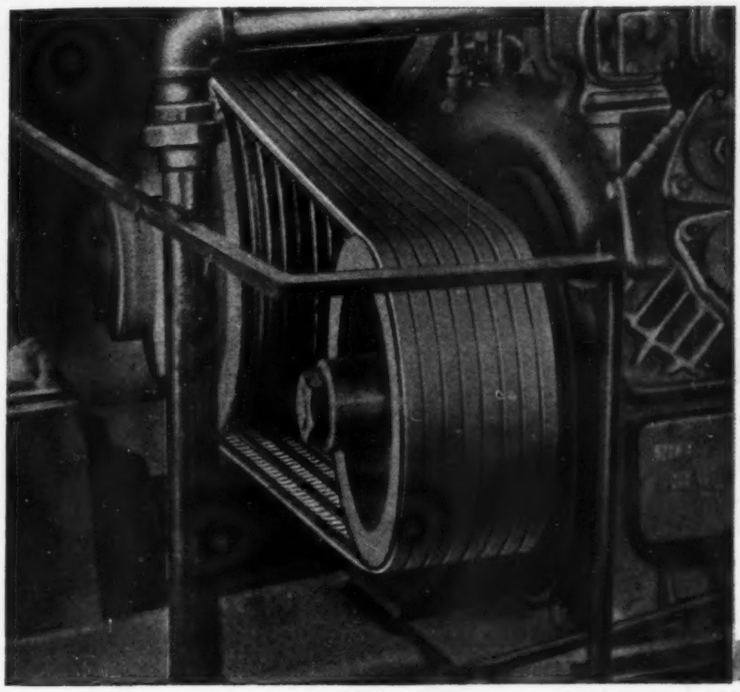
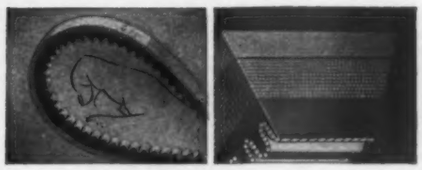
Peak Production, and...

DAYTON, THE GREATEST NAME IN V-BELTS, DELIVERS.



The Plus-Value DAYTON V-BELT



1 *The only V-Belt with patented built-to-bend construction—outstanding in basic design.*

2 *The only V-Belt made with Daytex Cord—and proved to run cooler and stand up longer under the strain of constant high speed flexing.*

So—on big jobs or on little jobs—inside or outside—wherever and whenever your power transmission needs call for fractional or a thousand horsepower—remember there is a plus-value Dayton V-Belt Drive ready to deliver more power at less cost and save you precious time, money and machinery. And remember, also, there is a Dayton distributor as near to you as your telephone.

THE DAYTON RUBBER MFG. COMPANY
DAYTON, OHIO
The World's Largest Manufacturer of V-Belts

FOR A LONG PULL and A HARD PULL IT'S...

Exhaustive tests prove that Dayton V-Belts with Daytex Cord have the *extra* strength, *extra* flexibility, *extra* life and *extra* gripping power to deliver plus-power transmission under rigorous conditions at less-cost-per-month-of-service.

The Plus-Value DAYTON V-BELT	
1	✓ + LONGER LIFE.
2	✓ + STRENGTH.
3	✓ + FLEXIBILITY.
4	✓ + COOLER RUNNING.
5	✓ + GRIPPING POWER.

Dayton
V-BELT DRIVES
WITH DAYTEX CORD

BRUSHES

use

Gold Stripe

For Maintenance —When you need paint brushes, get in touch with the nearest warehouse of the Pittsburgh Plate Glass Company. "Pittsburgh" can supply *on short notice*, top quality Gold Stripe Brushes for every paint application.

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Write for catalog and for information regarding the convenient contract service.

PITTSBURGH
PLATE GLASS COMPANY
BRUSH DIVISION · BALTIMORE, MD.

Warehouses In 81 Important Market Areas

control heat in 45 min. and glue temperature is maintained between 140 and 150 deg. F. by thermostatic control. Welded outer steel jacket with cast-aluminum glue container is provided. The box on the outside houses the adjustable thermostat and unit terminals where a flexible cord or BX connection can be made. Also available in ½-pt., 1-pt., 1, 2, 4, 6, and 8-qt. capacities. Vulcan Electric Co., 600 Broad St., Lynn, Mass.

Fork Truck

Lifting, carrying, tiering fork truck handles loads as heavy as 7,000 lb. and tiers them in piles 15 ft. high and higher. Particularly useful in car loading and unloading operations, stacking, serving production machines with materials and parts. It is said to be capable of 24-hr. opera-

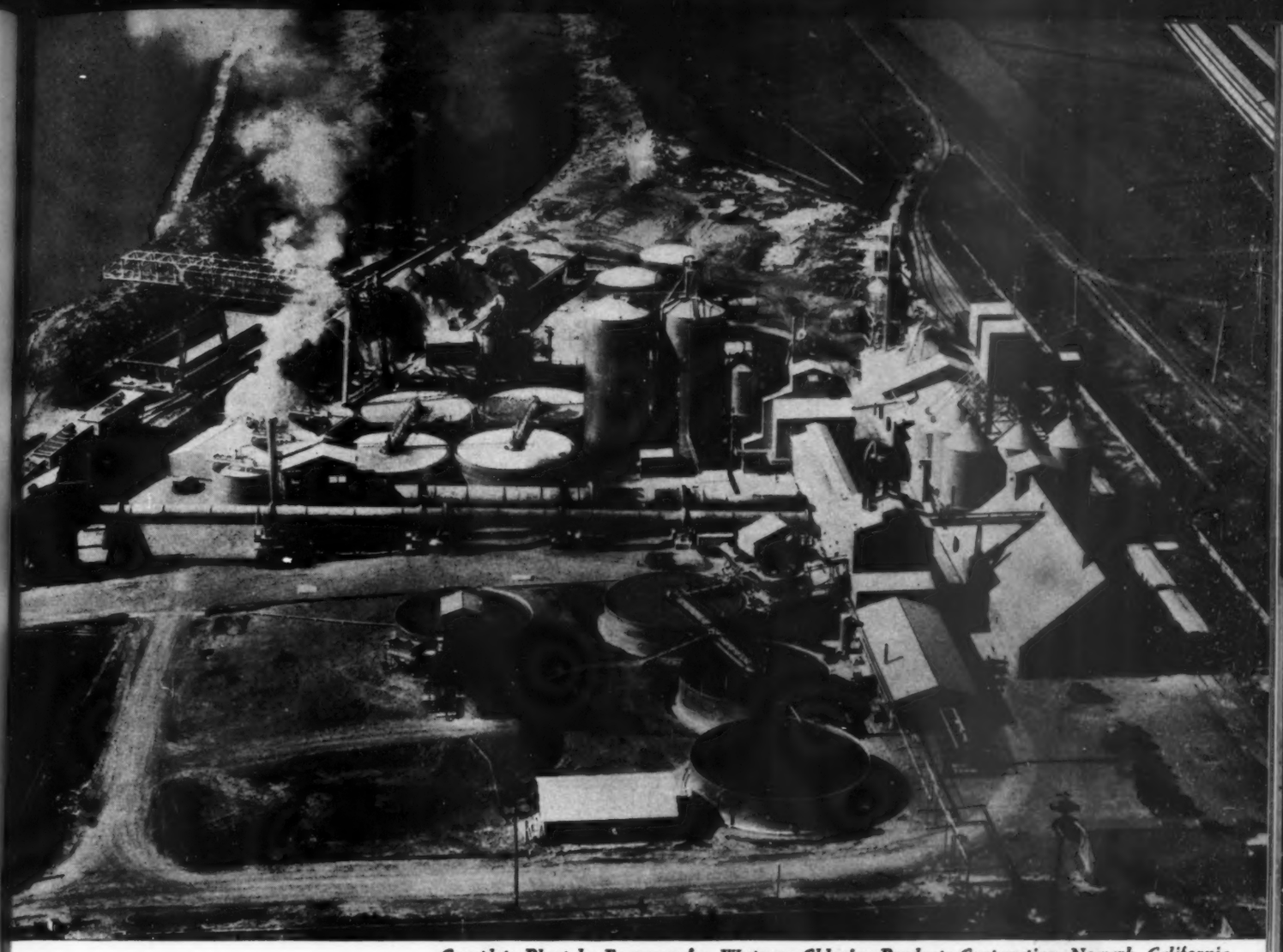
tion, is powered with a 6-cylinder heavy-duty tractor-type motor, travels at speeds 1-7 m.p.h. Lifting unit is powered with a hydraulic vane-type oil pump operated by direct drive from the motor and runs at two-thirds engine speed. Models include straight-lift, tilting, and telescopic-tiering types. Minimum height is 61½ inches. Heavy steel fingers with chisel points vary in length and are adjustable sidewise on front plate. Clark Tructractor Division of Clark Equipment Co., Battle Creek, Mich.

Explosion-Proof Lighting Fixtures

Series EV. Said to comply with requirements of Class 1, Groups C and D, for use in hazardous locations. Sectionalized fixture construction facilitates installation. Design includes canopy, connection block, shock-absorbing socket, inner reflector, Pyrex globe, cast Duraluminum guard. Relamping is accomplished by loosening thumbscrew and removing globe-holding assembly. Inner reflector remains in place as part of dome assembly. Appleton Electric Co., 1701 Wellington Ave., Chicago.

Motor for Compressor Drives

Special arrangement of stator windings makes it possible to reconnect a 3-phase motor at the terminal board for compressor-drive service on any one of three voltages. Designed particularly for application in



Complete Plant by Ferguson for Westvaco Chlorine Products Corporation, Newark, California

PRACTICE MAKES PERFECT

For over twenty years our Company has been helping important industrialists (1) by selecting, laying out, purchasing and finally installing and connecting approved production equipment for many kinds of complete new factories and power plants; (2) by designing and erecting the new buildings required to house these plants properly, and by providing all necessary service facilities; (3) by putting these factories, including all their equipment, into satisfactory operation before leaving the work. Our long experience has proved it definitely practicable for us to design, build and equip processing or other types of manufacturing plants with speed and with efficiency, within the limits of one organization and with one profit. A list of satisfied customer companies and their interested officials will be sent to you promptly on request. What we have done for others we can do for you if—you will come—telephone—telegraph—or write to our Cleveland or New York Office.

The H.K. Ferguson Co.

ENGINEERS AND BUILDERS

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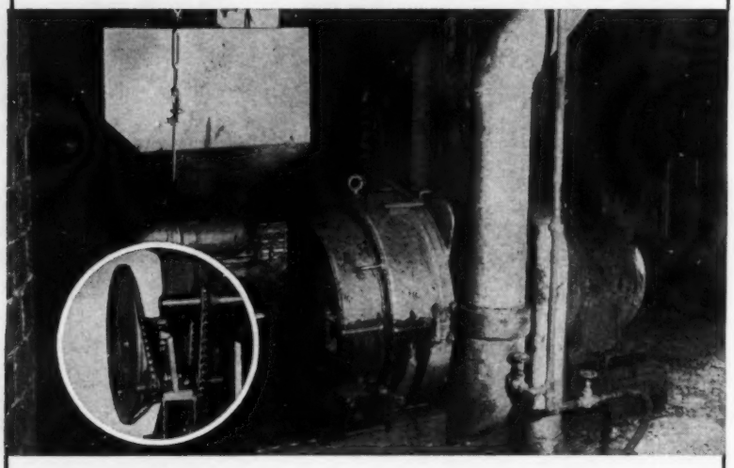


"WE HAVE a job requiring extreme flexibility and continuous service on small pulley diameters," reports THE SIMS COMPANY, manufacturer of the coal pulverizer shown above. "In addition, the working conditions are rather severe due to ash and coal being handled nearby, and in some cases at temperatures of around 120°F. We initially used endless V-Belts and had difficulty in matching pulley sizes and centers to the fixed lengths of these endless belts. Since we adopted Veelos V-Belting we get three important results:

1. We do not have to carry a stock of various lengths of endless belts.
2. We can ignore the problem of fixed pitched lengths of endless belts.
3. Best of all, our customers are obtaining much better belt life.

"*We appreciate your contribution to the betterment of our equipment.*" Let the Veelos distributor near you demonstrate the important results Veelos V-Belting can bring you.

Need technical advice on V-Belts? **CALL A V-MAN!** Veelos V-Men are sales engineers specially trained in power transmission work. They can give you valuable advice on difficult V-Belt installation problems. There is a V-Man ready to serve you — write when you want him.

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PA.

VEELOS
V-BELT
ADJUSTABLE to any length
ADAPTABLE to any drive

air conditioning and commercial refrigeration fields, it is ordinarily supplied for 199, 208, and 220-volt operation. Advantages claimed: proper torque to meet requirements of individual applications, operation on voltage available at the compressor (199, 208, or 220 volts), flexibility of installation, decrease in number of stock motors necessary for different applications in refrigeration and air conditioning fields. It is said that all the stator winding is used all the time thus maintaining motor characteristics under all operating circumstances. The motor incorporates the Valv-Amp rotor and is available in sizes through 200 horsepower. General Electric Co., Schenectady, N. Y.

Temperature-Control System

Remote Bulb Econostat, an electric inside-outside temperature-control system for regulation of the heating system in office buildings and factories, is intended for those installations which cannot be satis-

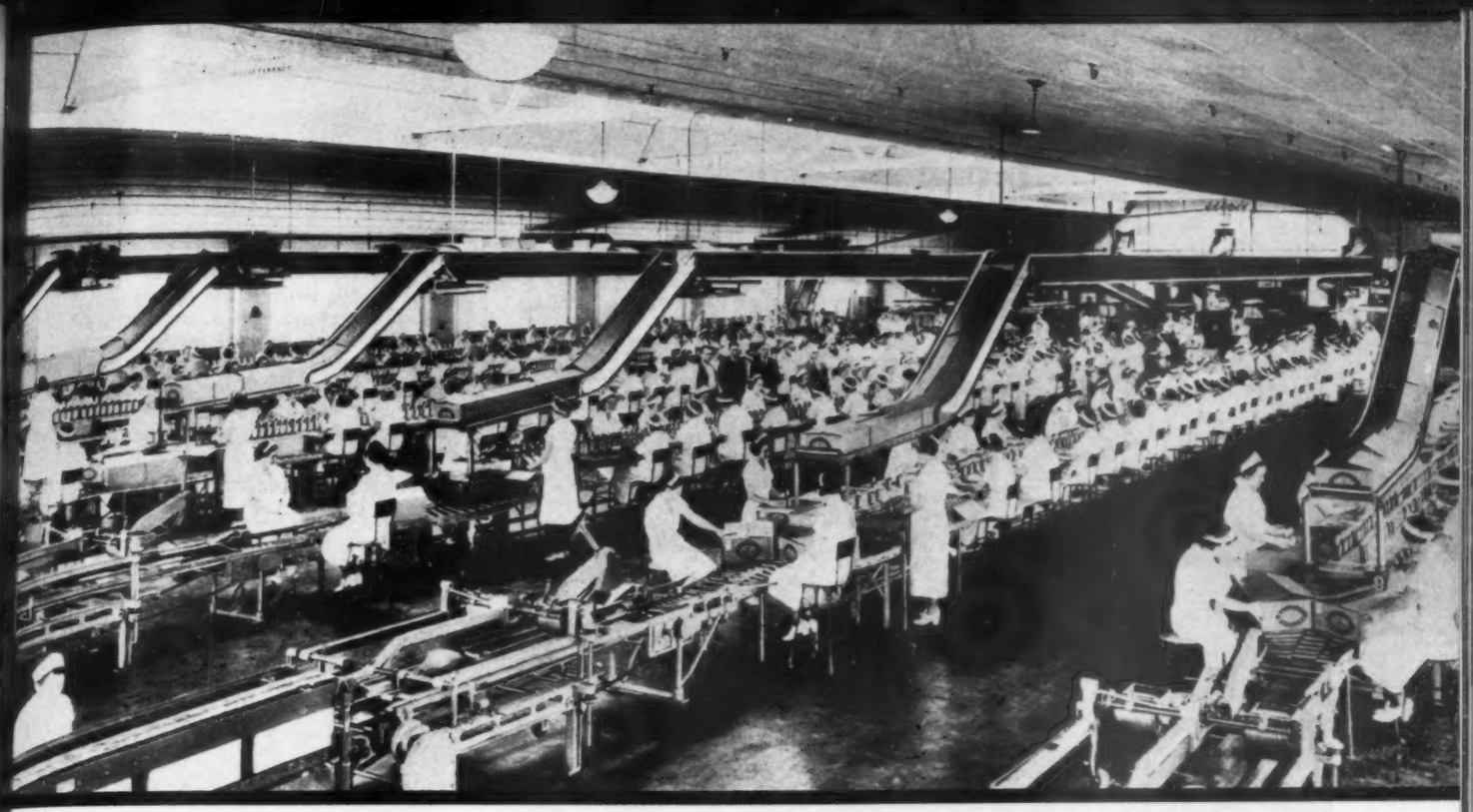
factorily controlled from a single thermostat. It maintains the desired indoor temperature by varying the "heat on" periods in accordance with outdoor temperature changes. Thus it works to supply heat to the building in proportion to heat loss and is not dependent on temperature in any particular room. It is completely automatic, can be installed in new or existing buildings, and will control any type of heating system fired by gas or oil burner, stoker, central station steam. Barber-Colman Co., Rockford, Ill.

Pillow Blocks

Equipped with neoprene seals to protect the bearings and retain lubricant. The labyrinth-type seal rings turn with the shaft and float in the housing. Complete unit consists of self-aligning ball bearings mounted in one-piece Parkerized housing, labyrinth seals, and removable end cap. Ahlberg Bearing Co., 3047 West 47th St., Chicago.

Electronic Level Control

Type P30 is an electronic relay for level control of both conductive and non-conductive fluids and powders. Carrying only milliamperes of current and low voltage, it may be used with combustibles. May also be used in connection with such insulators as resin, rubber, latex, paraffin, mica, glass, cement, linseed oil, shellac,



WITHOUT EXPANDING, YOUR PLANT TOO CAN PRODUCE MORE!

IF YOU are the person entrusted with the almost superhuman job of stepping up production during the present "National Emergency"—then you will want to read this advertisement. If that job is entrusted to some other person, you will do him a favor by passing this advertisement on to him.

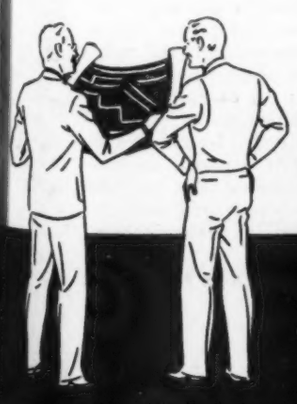
Why? Because you know that the only ways to produce more goods in a shorter time are: (1) *the enlargement of present plant facilities,* (2) *the construction of additional facilities,* (3) *the "streamlining" of present production methods.*

For over forty years we have, through the introduction of endless-stream materials handling systems, helped scores of companies, large and small, to "streamline" production methods and to increase production capacity without increasing floor space.

Look, for instance, at the plant shown above. It is typical of many others producing all types of materials for defense, as well as consumer merchandise, that have stepped up production through the installation of a modern "Scientifically Planned" Alvey-Ferguson Conveying System. Highly efficient today, this "Scientifically Planned" layout is also flexible enough to meet demands next month, next year—ten years from now! Variable speed drives permit pace changes for production in various sizes and styles. Any one of the lines may be easily converted to handle a *different* size and type of material.

Whatever your particular problem—large or small—the competent advice of an Alvey-Ferguson Engineer is yours for the asking. There is no obligation on your part for this counsel service extending from coast to coast. Write today to The Alvey-Ferguson Co., 110 Disney Street, Cincinnati, Ohio.

FREE—*To Executives, Plant Superintendents and Engineers. A new catalog that graphically shows you the correct answers to many materials handling problems. Write for it—today.*



ALVEY-FERGUSON

CONVEYING A=F MACHINERY

HOW ABOUT LOW OVER-ALL COSTS AND LONG-RUN SATISFACTION?

WHAT ROOF DECK CAN BE ERECTED FAST?

IS IT STRUCTURALLY SOUND?

HOW CAN WE AVOID COLD-WEATHER DELAYS?

WHAT ABOUT INSULATING VALUE?

IS IT FIREPROOF?

"No cold-weather troubles with Milcor Roof Deck"

"No sir — the roof structure is erected right on schedule"

MILCOR Steel Roof Deck — the economical answer to the problem of getting your plant into production quickly

Free, colorful manual shows how you get your building, large or small, under cover quickly, even in bad weather, with Milcor Steel Roof Deck — just as was done on a Kearney & Trecker Corp. addition (Milwaukee, Wis.) where over 70,000 sq. ft. of deck were laid, some of it in 15-below-zero weather, in only 110 working hours! Shows how Milcor Steel Roof Deck is quickly attached—with clips or welding — to any structural member . . . how it is adaptable to any type of insulation. Points out how fire-safety, permanence, and long-run economy give you a better all-around roofing job that upholds your sound judgment in insisting on Milcor. Tells about Milcor's free, helpful lay-out service. Let the Milcor Roof Deck Manual save your time in planning, designing. Write for it today. F-180

• *Above:* Welding deck sheets on Kearney & Trecker plant addition.

• *Below:* Finished section ready for cork insulation. Insulators and roofers closely follow erectors.

MILCOR STEEL COMPANY

MILWAUKEE, WIS. CANTON, OHIO

CHICAGO, ILL. • KANSAS CITY, MO. • LA CROSSE, WIS. • NEW YORK, N.Y. • ROCHESTER, N.Y. • BALTIMORE, MD.

Sales Offices: Minneapolis, Minn., Little Rock, Ark., Dallas, Tex., Denver, Colo., Washington, D. C.

mineral oil, wax, waterglass, lacquer, and thinner. Special tank fittings are available for use in corrosive liquids. Equipment may be had for all specifications including single-level control, on-and-off control at two levels, boiler feedwater control, tank condensate signals. To install, attach a probe fitting to the surface of the tank. For two-level control, probe fittings or electrodes are attached to the tank at levels representing the low point where pumping starts and high level where pumping stops. Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass.

Magnetic Motor Starters

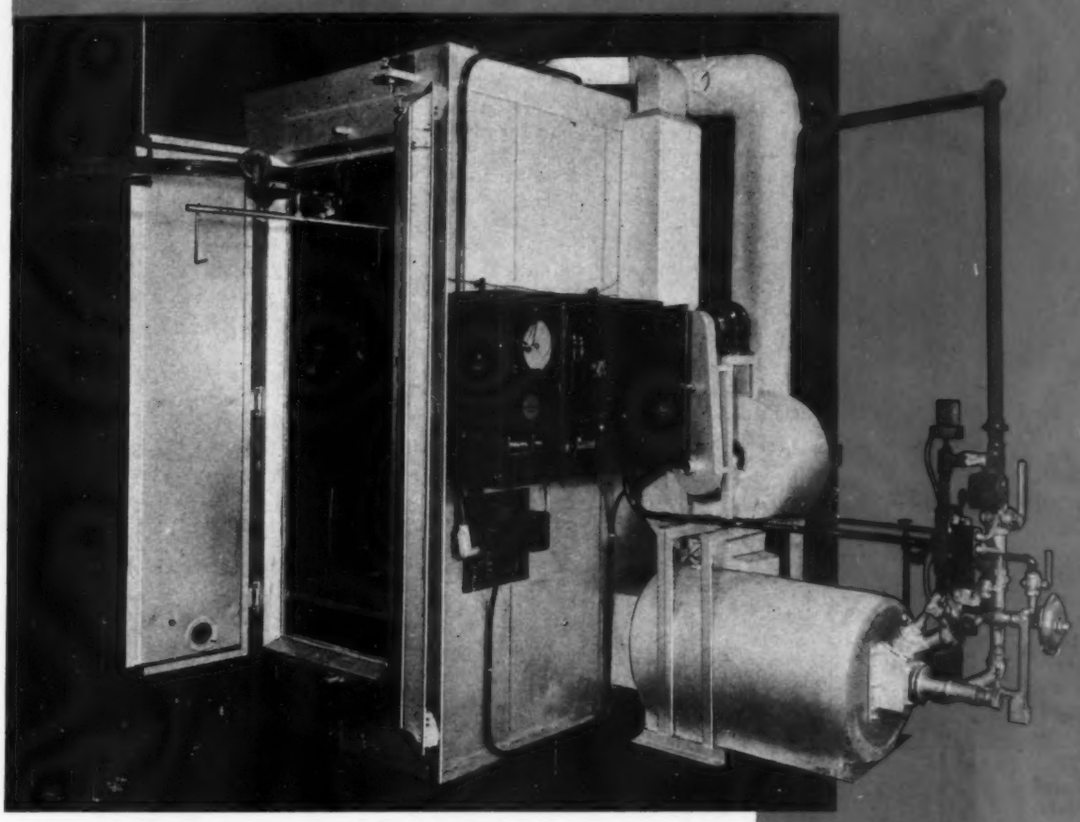
Designed for across-the-line starting of single and polyphase squirrel-cage induction motors and as primary control for wound-rotor induction motors. Can be used on many small motors and on practically all large motors as they allow automatic control, local or remote control, or control from 2 or more locations. They

also provide low-voltage release and no-voltage protection as well as protection against damaging over-loads to motors. Applications include conveyors, compressors, pumps, ventilators, motor generators, machine tools. Three-point ball-bearing suspension of the movable electro-magnet assures floating action. Operating vertically the magnet cannot, it is said, close accidentally by vibration or shock. Supplied in general-purpose sheet-steel cabinets, in water-tight weatherproof cast-aluminum enclosures, or as interior only for special applications. Colt's Patent Fire Arms Mfg. Co., Electrical Division, Hartford, Conn.

Oxygen Recorder

Oxygen recorder measures and records oxygen content of process gases, excess air in products of combustion, and air in gas transmission systems. All parts are assembled in a steel panel measuring 30 in. wide and 7 ft. high. It is said to furnish precise measurements of oxygen concentrations from 0 to 20.8 percent and to be able to be calibrated for any range desired within the above limits. Other advantages claimed: All conductors carrying sample and solution are of hard rubber, clear plastics are used instead of glass where transparency is required, construction of electrical control box excludes corrosive gases, electrical parts and conductors are enclosed in explosion-proof

OVENS



MAHON BOX OVENS . . . . .
To Fit Every Industrial Need

In addition to designing and constructing conveyor type ovens for large installations where progressive production is extensive, MAHON also offers a wide range of box type ovens, used for paint drying, core baking, steel drawing, etc., within the temperature range of up to 850° F. These ovens are sub-assembled at our factory for easy installation in your plant. Sizes are optional. Equipment, such as overhead trollies, shelves, etc., can be fitted to your individual needs. Heating media may be arranged for gas or oil—direct or indirect—or for electricity or steam, if desired. Control apparatus meets rigid requirements of insurance underwriters. Inquiries will receive prompt attention.

For Use In NATIONAL DEFENSE Production

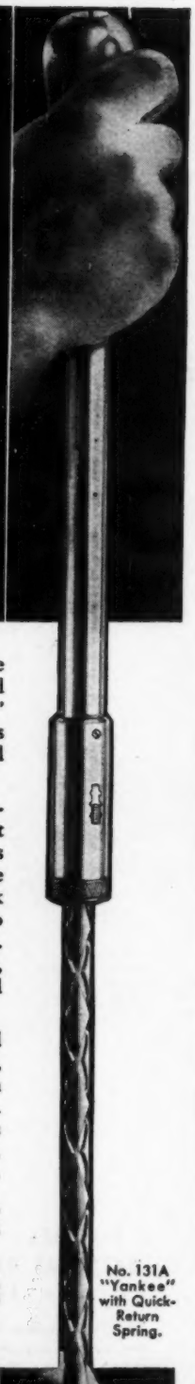
Box Type Ovens are essential to the manufacture of many items of National Defense production. MAHON engineers will gladly confer with you on this important requirement.

THE R. C. MAHON COMPANY
DETROIT—CHICAGO

Designers and Manufacturers of Complete Finishing Systems, Metal Cleaning Machines, Rust Proofing Machines, Hydro-Filter Spray Booths, Ovens of All Types, Filtered Air Supply Units, Hydro-Foam Dust Collectors and many other Units of Special Production Equipment.

MAHON

SPEED UP WITH "YANKEE" SPIRALS



Because they increase output, save time and labor, "Yankee" Spiral Screw Drivers will help you speed production.

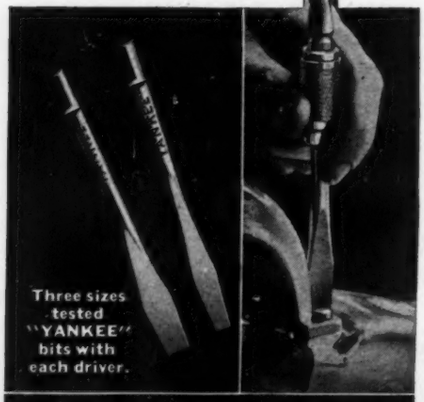
Available with "quick-return" spring that automatically keeps bit in position while bringing handle back for next stroke. Also made without spring. All have right-hand, left-hand ratchet and rigid adjustments.

Light, standard and heavy patterns. Sizes, from 12⅜" to 28" with spindle extended. Exposed metal parts chromium plated.

Order "Yankee" Spirals, Vises, Drills, etc., from your Mill Supply House.

"YANKEE" TOOLS
make better mechanics

No. 131A "Yankee" with Quick-Return Spring.



Three sizes tested "YANKEE" bits with each driver.

NORTH BROS. MFG. CO.
PHILADELPHIA, U. S. A.

fittings, carbon dioxide and other acid gases can be removed from interference with operation when necessary by a caustic scrubber. Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh.

Transmission Units

Series of ball-bearing pillow blocks, flange cartridges, and cylindrical cartridges features Mechani-Seal ball-bearing construction, wide inner-ring design with self-locking collar. Locked to the shaft with a finger-twist, they require no machining, shaft shoulders, adapters, or locknuts. Two steel-plate shields form the innermost members and are tightly fitted to the bearing outer ring. An outer corrosion-proofed steel plate shield pressed on the inner ring clears the inner plates by close tolerances and acts as a slinger. The Fafnir Bearing Co., New Britain, Conn.

Skid Platform

Steelwave skid platform features "strength without weight." Advantages: Light-gage metal corrugated crosswise in the deck, and lengthwise at right angles to the deck in side angles; rounded corners for safety; no shrinking, swelling, warping, or buckling from atmospheric conditions. Fabricated from sheet metal 16 to 12-gage according to required capacity. Deck and side angles are die formed and legs are $\frac{5}{16}$ by $1\frac{1}{2}$ in. flat steel. Parts are fused by electric welding. Platform sizes range from 24x42 in. to 36x72 in. Minimum clearance, floor to underside of deck, is $6\frac{1}{2}$ in.; maximum is 12 inches. Two or four-way lift truck entrance types are available. Standard capacities: 3,500 and 5,000 lb., special capacities are custom built. The Service Caster & Truck Co., 505 North Brownswood Ave., Albion, Mich.

Insulated Stud Connector

Type ZMDZ for joining several cables to smooth or threaded stud is specially suited for stud connections in underground distribution systems, at network protectors, on secondary terminals of underground transformers. The cables are each gripped by compression cone clamping elements and the stud is also gripped by a compression cone threaded to screw onto the stud. Insulation is completed by taping exposed metal parts or by use of insulating sleeves which can be furnished. Available for joining various sizes and numbers of cable. Burndy Engineering Co., Inc., 459 East 133d St., New York.

Paint and Chemical Mixing Truck

Steel mixing truck of special use to paint and varnish manufacturers, food plants,

DRIVE PHILLIPS Recessed Screws with "YANKEE"

QUALITY SCREW DRIVERS

—Two Styles—
HEAVY DUTY *and* **REGULAR**

HEAVY DUTY
No. 901–1 Point
No. 902–2 Point
No. 903–3 Point
No. 904–4 Point

REGULAR
No. 941–1 Point
No. 942–2 Point
No. 943–3 Point
No. 944–4 Point

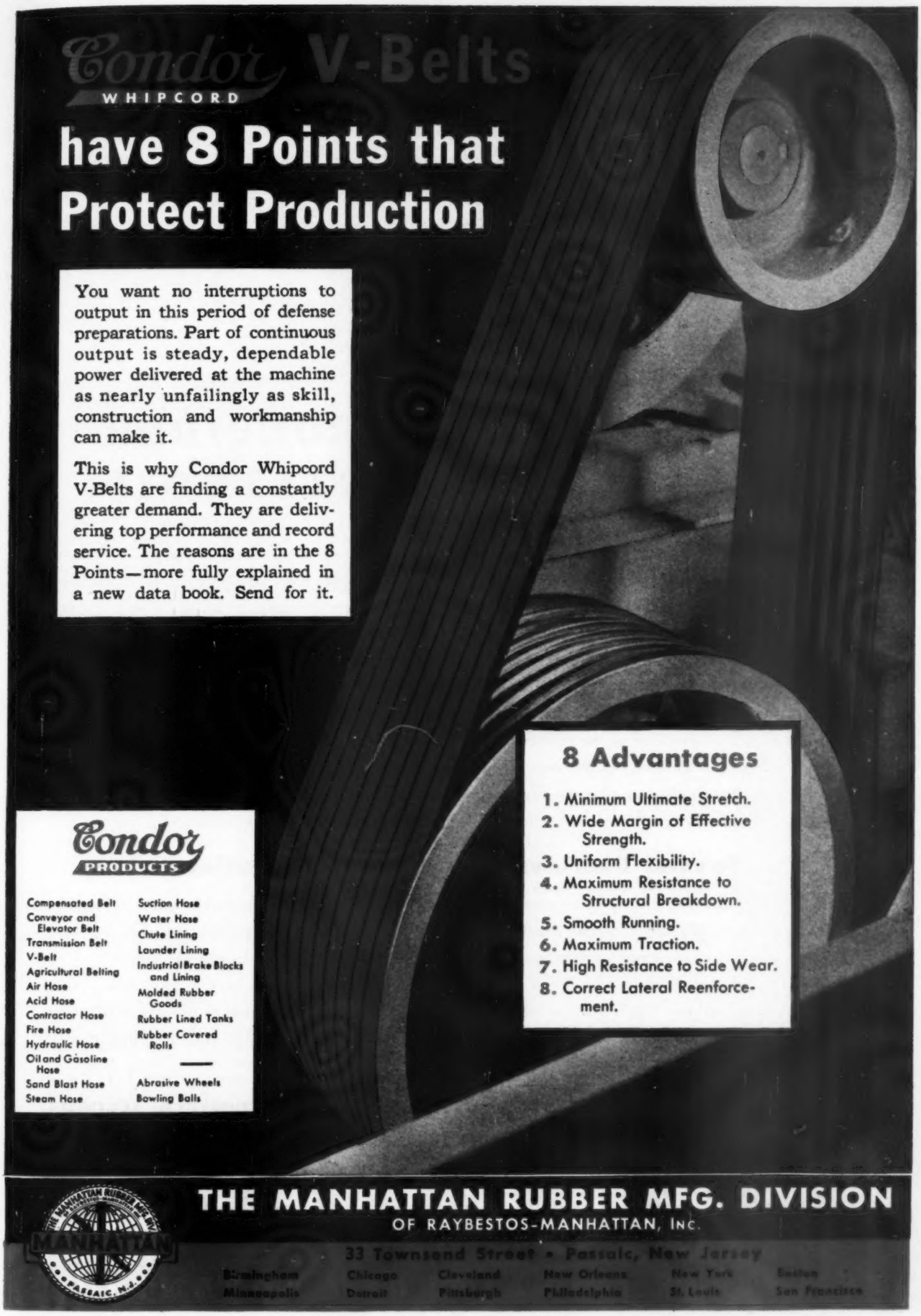
"YANKEE" PHILLIPS BITS *for use in all* **"YANKEE" SPIRAL SCREW DRIVERS**

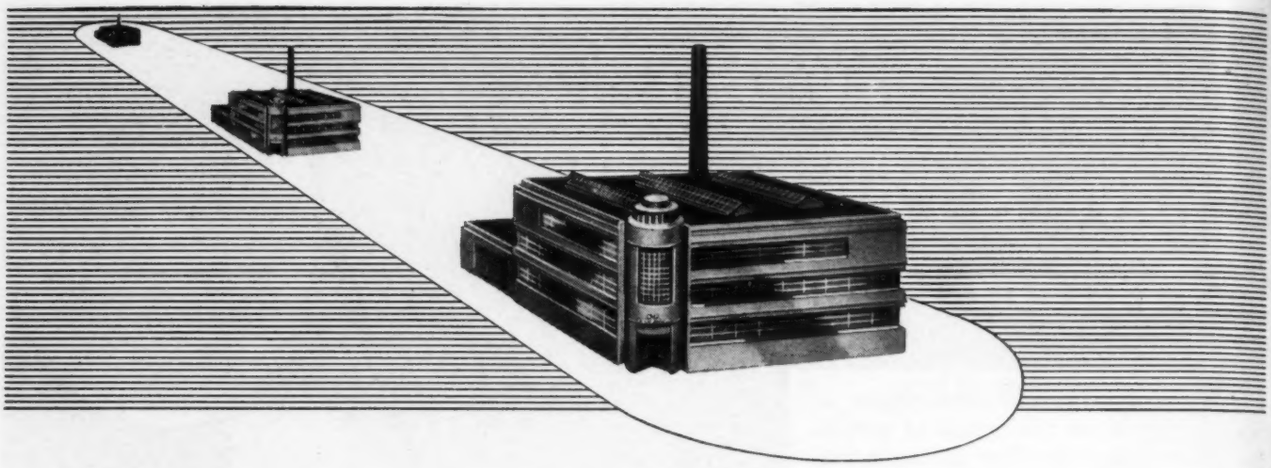
PHILLIPS LIC. 3 Patent Nos. 2046837-2046840-2066372.

"Yankee" Phillips screw driver blades and bits are of special alloy steel; the best obtainable for the purpose. They are hardened and tempered to the proper degree for the driving of Phillips Screws, including the sheet-metal, self-tapping types of screws which are being used very extensively.

Write us for further details.

NORTH BROS. MFG. CO.
Dept. F Philadelphia, U. S. A.


Condor V-Belts
WHIPCORD
have 8 Points that Protect Production
You want no interruptions to output in this period of defense preparations. Part of continuous output is steady, dependable power delivered at the machine as nearly unfailingly as skill, construction and workmanship can make it.
This is why Condor Whipcord V-Belts are finding a constantly greater demand. They are delivering top performance and record service. The reasons are in the 8 Points—more fully explained in a new data book. Send for it.
8 Advantages
1. Minimum Ultimate Stretch.
2. Wide Margin of Effective Strength.
3. Uniform Flexibility.
4. Maximum Resistance to Structural Breakdown.
5. Smooth Running.
6. Maximum Traction.
7. High Resistance to Side Wear.
8. Correct Lateral Reenforcement.
Condor PRODUCTS
Compensated Belt
Conveyor and Elevator Belt
Transmission Belt
V-Belt
Agricultural Belting
Air Hose
Acid Hose
Contractor Hose
Fire Hose
Hydraulic Hose
Oil and Gasoline Hose
Sand Blast Hose
Steam Hose
Suction Hose
Water Hose
Chute Lining
Launder Lining
Industrial Brake Blocks and Lining
Molded Rubber Goods
Rubber Lined Tanks
Rubber Covered Rolls
Abrasive Wheels
Bowling Balls
THE MANHATTAN RUBBER MFG. DIVISION
OF RAYBESTOS-MANHATTAN, INC.
33 Townsend Street • Passaic, New Jersey
Birmingham Chicago Cleveland New Orleans New York Boston
Minneapolis Detroit Pittsburgh Philadelphia St. Louis San Francisco



Expanding? CONSIDER ILLINOIS

IF your business is expanding, consider the profit possibilities of a branch plant in Illinois. Here, closest to the CENTER OF MANUFACTURING, the CENTER OF AGRICULTURE, the CENTER OF POPULATION, and the GEOGRAPHICAL CENTER OF THE NATION, you will gain the benefits from these profit factors.

The advantages of Illinois, which have made possible the industrial growth of the State—from fifteenth to THIRD in value of manufactured products in less than a century—are profit factors deserving of your consideration in your plans for present or future expansion.

Illinois is the cross-roads of the Nation in industry and trade. Direct rail, highway, air, and water transportation facilities are available to the markets of the Nation, of Central and South America, and of foreign nations. The huge Middle West Market, with a population in excess of 50,000,000 is within overnight freight shipping radius. Branch plants in Illinois—closer to raw materials, to markets, to sources of good labor, and to other sought after advantages—have proved the wisest method of expansion in many industries.

Special Confidential Report to Executives

Get the facts on Illinois as they apply to your business. Write the Illinois Development Council at Springfield for a special report containing complete details of raw materials, labor, taxes, power, fuel, transportation, and other facts which have an important bearing upon the selection of an advantageous plant location.

Please explain the nature of your business, and list any special problems you have in production, sales, distribution, or any unusual requirements in labor supply, type of building, raw materials, or other manufacturing needs, in order that a completely informative and practical report may be submitted to you. Your inquiry will, of course, be kept confidential. Write—

ILLINOIS DEVELOPMENT COUNCIL • STATE HOUSE • SPRINGFIELD, ILLINOIS

ILLINOIS

THE STATE OF BALANCED ADVANTAGES

chemical plants, dye manufacturers, laboratories carries a tank with top cover opening in two hinged halves with hook and eye to fasten both halves of cover when opened. A hand crank turns propeller agitator inside to stir or mix contents. Tank measures 25 in. diameter by 24 in. deep, capacity is 51 gallons. Over-all height of unit is 39 in., size of pouring spout is 3 in. gate, casters are 8x2 in. rubber tired, approximate weight is 330 pounds. All Steel Welded Truck Corp., Rockford, Ill.

Voltage Regulators

For automatic voltage control of small a.c. and d.c. generators, a quick-acting rheostatic type regulator known as the Silverstat Junior Regulator has been made available in d.c. ratings up to 25 kw. and

a.c. ratings up to 44 kva. Voltage of machine to be regulated is connected across the regulator coil and any change in voltage results in a corresponding change in magnetizing effect of the coil on the magnetic circuit. Attractive force on armature will be increased or decreased causing armature to seek a new position. This will either close or open in sequence an assembly of silver buttons to short out or insert steps of a carbon-plate resistor in series with field circuit of the generator —said to keep generator output voltage within 3 percent of normal. Westinghouse Electric & Mfg. Co., Dept. 7-N-20, East Pittsburgh.

Interval Timer

Model D2 finds use on various types of mixers, tumbling barrels, heat-treating furnaces, laundry machines, and other applications in which timers may be subjected to excessive moisture and dust conditions. The splash-proof cast-aluminum housing is arranged for conduit connection and is provided with a full-vision window and external setting knob. Front-view bullseye light signals can be supplied. Features: Available in 12 different scales ranging from one revolution in 15 sec. to one in 24 hrs., 3-in. diameter dials, unbreakable non-clouding type window, setting knob, screw-fastened cover made of ⅛-in. black bakelite sealed by a rubber gasket. The R. W. Cramer Co., Inc., Centerbrook, Conn.

THE PUL-LIFT IS "at home" ON ANY JOB

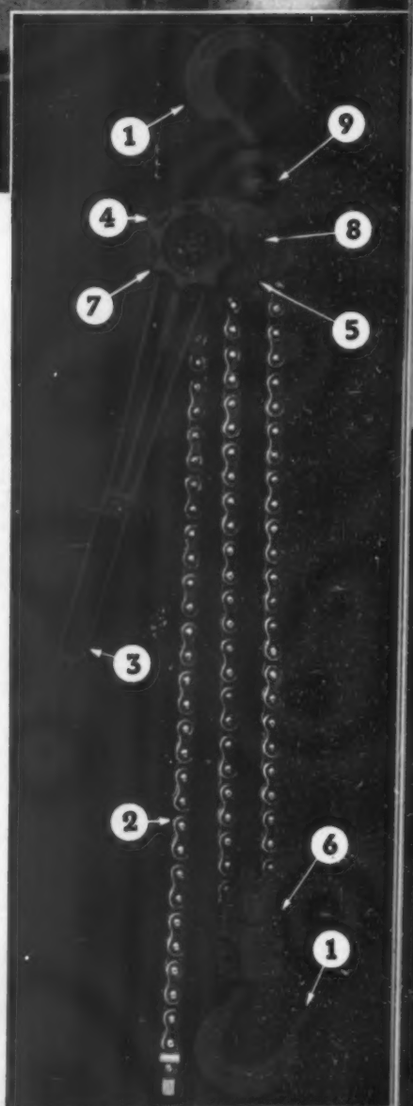
The Yale Pul-Lift is the most versatile tool you ever saw . . . it fits in on almost any kind of job. You can't get it out of position. *It pulls! It lifts!* No tool chest should be without it.

It's *truly* a portable hoist . . . weighs approximately 75% less than conventional portable hoists. In addition, the Pul-Lift brings you these extra features:

1. **Safety top and bottom hooks** open slowly, without fracture, in case of severe overload. Positive protection to the operator, the load and the mechanism!
2. **Roller Chain** is specially designed and free-rolling. Heat-treated steel parts give this chain ultimate strength nearly five times the rated capacity of the hoist for *plus* safety!
3. **Universal ratchet-type handle action** for short easy strokes in cramped quarters. Operated at any point in a complete circle. You can't corner this hoist!
4. **Self-actuated load brake,** screw and disc type. Brake pressure increases in direct proportion to the load. There's not a possibility of a flying handle!

Ask your distributor to tell you about (5) the strong housing, (6) special bottom hook swivel, (7) handwheel that frees the chain, (8) heat-treated load sprocket, (9) ease of lubrication and the many other features of this all-purpose tool that both pulls *and* lifts. Or write to us direct.

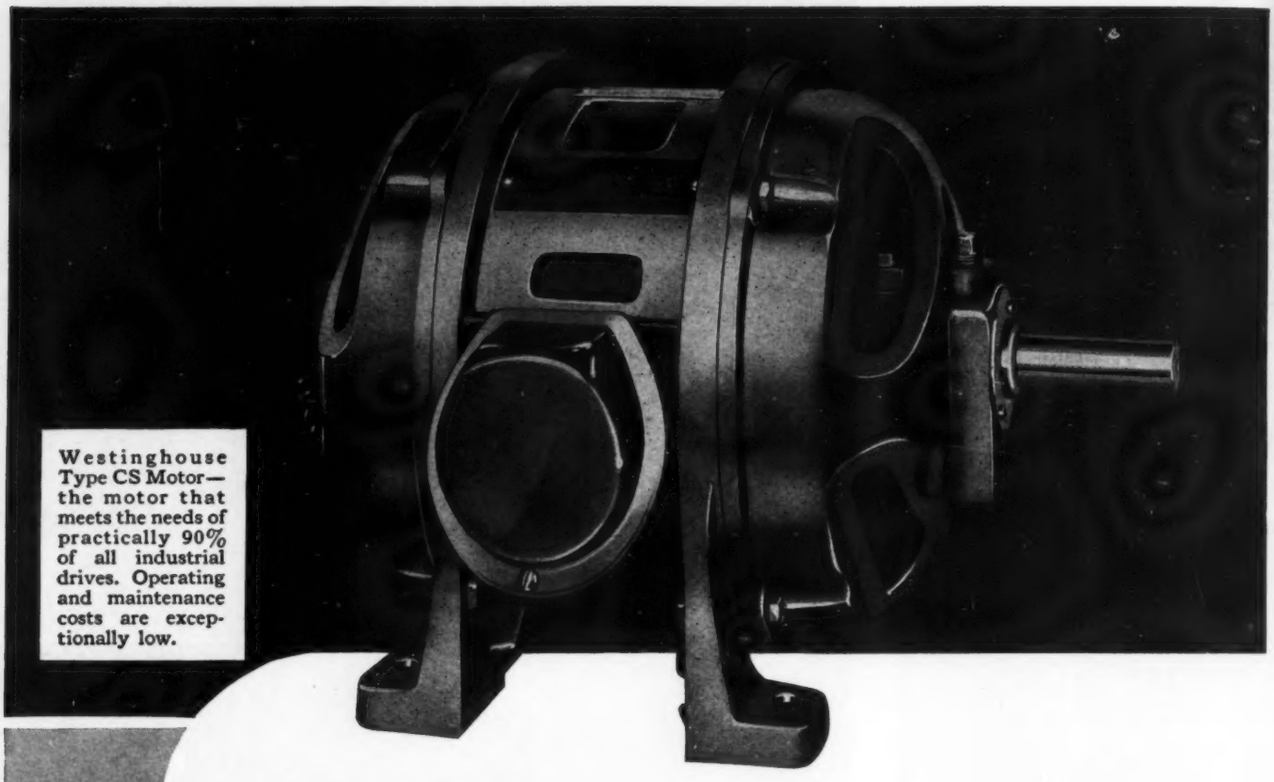
Capacities ¾ to 6 tons



THE YALE & TOWNE MFG. CO.
PHILADELPHIA DIVISION, PHILADELPHIA, PA., U. S. A.
IN CANADA: ST. CATHARINES, ONT.

YALE

Makers of Yale Hand Chain Hoists, Electric Hoists, Electric Industrial Trucks, Hand Lift Trucks and Skid Platforms.



Westinghouse Type CS Motor—the motor that meets the needs of practically 90% of all industrial drives. Operating and maintenance costs are exceptionally low.

$2500 Saved and..

Westinghouse Motors Show Way to New Savings

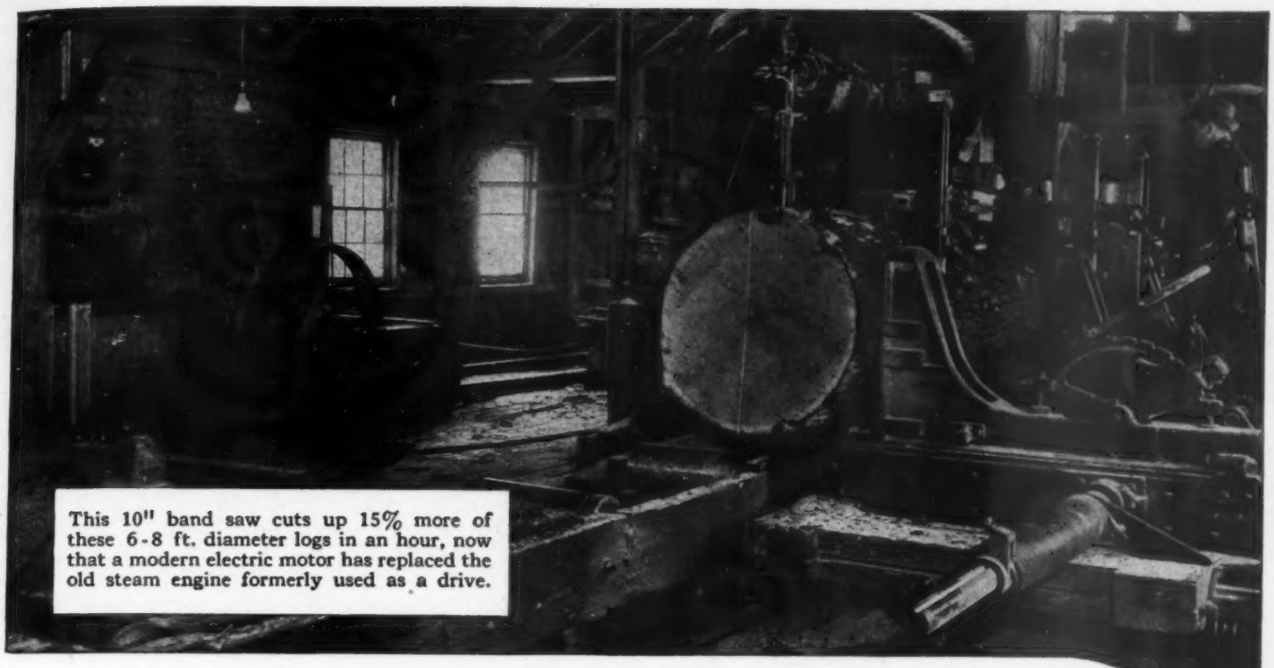
Here's a general purpose induction motor that meets the needs of practically 90% of all industrial drives. It's the Type CS, Line-start Motor, built by Westinghouse, the organization that developed the original squirrel-cage motor back in 1896. Design and construction are backed by over 40 years of continuous motor development.

Dependable performance and long life are built into every feature of design. Windings are protected from the attack of excess lubricant by exclusive Westinghouse features on both ball and sleeve type bearings. Extra mechanical strength, secured by *rigid one-piece* frame construction, assures permanent alignment and minimum vibration. *Tuffernell insulation* throughout, gives extra electrical strength—a plus value at no additional cost.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
East Pittsburgh, Pennsylvania

Westinghouse

W
WESTINGHOUSE ELECTRIC



This 10" band saw cuts up 15% more of these 6-8 ft. diameter logs in an hour, now that a modern electric motor has replaced the old steam engine formerly used as a drive.

Production Boosted 15%

Change to Electric Drive Pays Dividends for Morsches-Nowels Lumber Co. of Columbia City, Ind.

Steam supplied the power for this 10" band saw until increased business created a demand for more steam than the boiler could supply. Increased boiler capacity was needed.

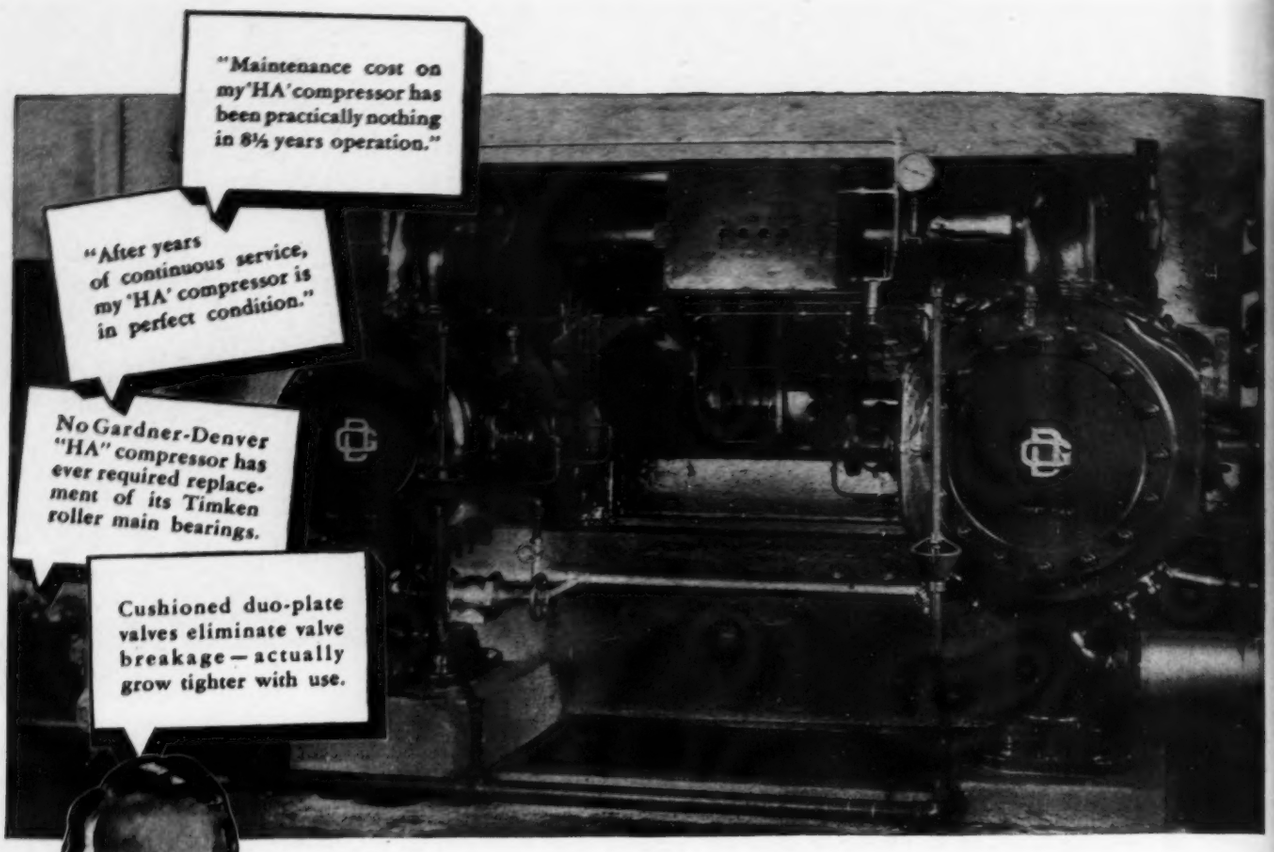
A study quickly proved that a Westinghouse 100 hp motor could meet power requirements, handle the saw at a higher speed and save $2500 on installation costs. After motorization production jumped 15%. With these savings, the whole installation will repay its original investment in 10 months.

Similar chances to save on investment and increased production may exist at this moment in your plant. A power survey will disclose them. Why not ask for a Westinghouse survey today. It's free . . . you incur no obligation . . . your chances for profit are great.

Here's the efficient, space-saving Westinghouse motor that replaced steam power. By saving $2500 on power equipment, and stepping up production 15%, the whole installation will pay for itself in 10 months.

J-21055

Motors and Control

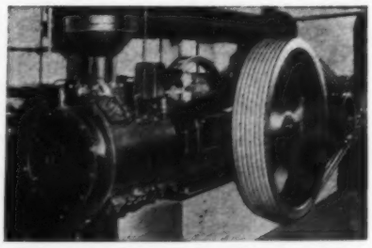

"Maintenance cost on my 'HA' compressor has been practically nothing in 8½ years operation."
"After years of continuous service, my 'HA' compressor is in perfect condition."
No Gardner-Denver "HA" compressor has ever required replacement of its Timken roller main bearings.
Cushioned duo-plate valves eliminate valve breakage — actually grow tighter with use.

"The Dependable Operation of Our GARDNER-DENVER 'HA' Compressor Is Second to None"

● Gardner-Denver Class "HA" Two-Stage Horizontal Air Compressors have established a reputation for sustained high efficiency and low operating costs that is *second to none.* Under widely varying operating conditions—in all sections of the country—they have fully proved their ability to provide plenty of air at low cost.

Why? Among the many answers is the fact that Gardner-Denver Compressors are equipped with control apparatus that automatically fits the output to the amount of air required. Where the requirements are less than full capacity, the compressor is automatically adjusted to deliver 75%, 50% or 25% of capacity. This results in sizable savings. You don't pay for unnecessary power when air requirements are low, while, at the same time, you are able to get all the air you require when operating at peak capacity.

Assure *your* plant an unfailing, economical air supply for the busy months ahead. Write us for complete facts about Gardner-Denver "HA" Air Compressors. Gardner-Denver Company, Quincy, Illinois.



An inadequate air supply was tying up operations in the spray booths of a large midwestern plant. The trouble vanished when two small, vertical compressors were replaced by this Gardner-Denver RX Single-Stage Horizontal Compressor. The user reports that with the RX, his current costs are actually lower for a larger air supply.

GARDNER-DENVER SINCE 1859

Steel- FIRST LINE OF NATIONAL DEFENSE

Republic Operates the World's Largest Stainless Steel Finishing Mill—

Ten years ago, Republic operated the world's largest stainless steel finishing plant. Each year it seemed to become smaller as ENDURO Stainless Steel found its way into new products—automobiles, trains, airplanes; chemical, textile and food processing equipment; home appliances and even fine jewelry.

Actually, the plant has been enlarged—now covers five acres of floor space—and much new finishing equipment has been added so that, today, Republic still operates the largest stainless steel finishing plant in the world.

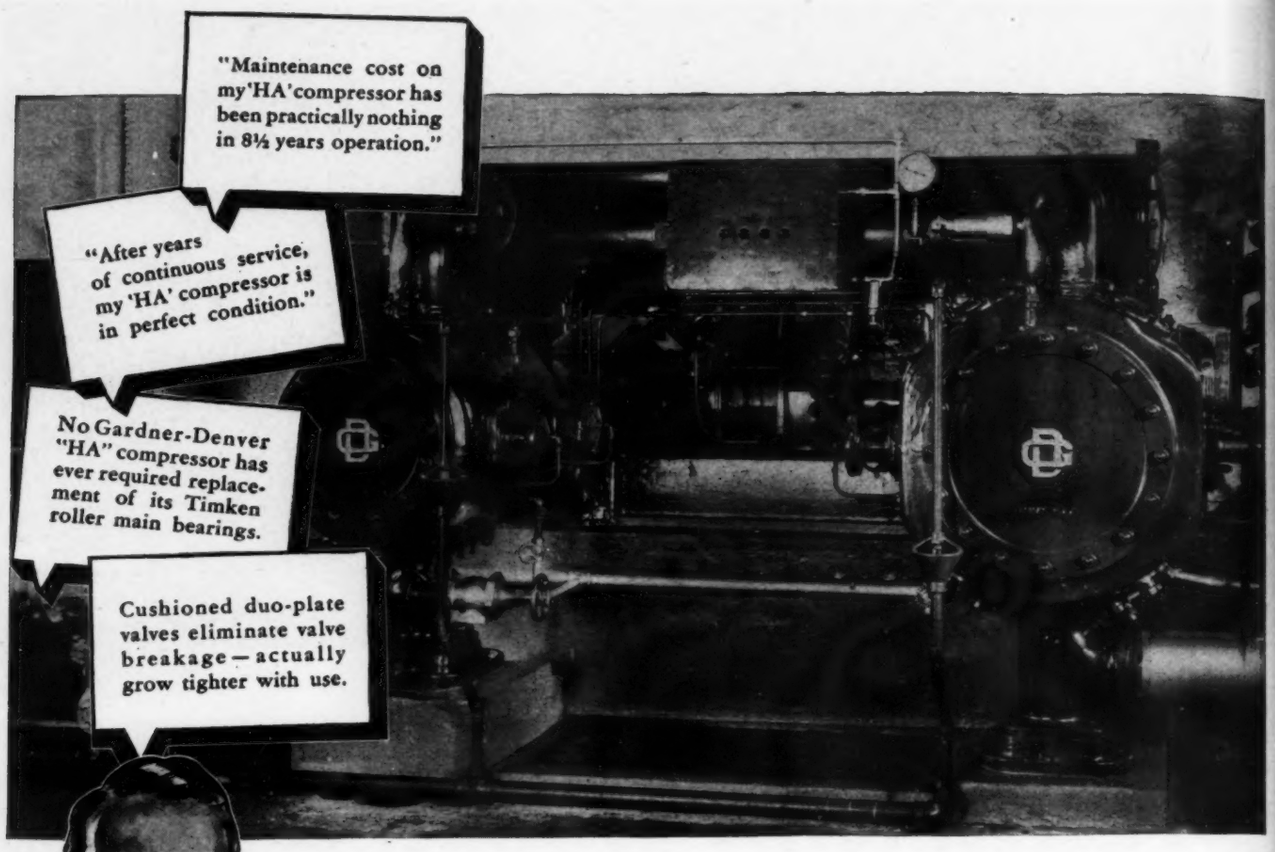
Now, to the huge peace-time need for ENDURO for a wide variety of every-day uses is added the demand of industry working feverishly in the defense of America—for bomb chutes in planes, galleys in naval craft, floats for flying boats and a host of other uses where high strength and heat- and corrosion-resistance are imperative.

Republic has looked ahead—has expanded all its facilities—and, fortunately for every man and woman interested in preserving our freedom, is able and anxious to help in the crisis that now squarely faces America—with more and better ***steel—first line of national defense.***

The line of steels and steel products manufactured by Republic is so diversified that we have prepared a complete listing in Booklet No. 199. A copy will be sent you upon request.

REPUBLIC STEEL CORPORATION • CLEVELAND, OHIO

BERGER MANUFACTURING DIVISION • CULVERT DIVISION • NILES STEEL PRODUCTS DIVISION
STEEL AND TUBES DIVISION • UNION DRAWN STEEL DIVISION • TRUSCON STEEL COMPANY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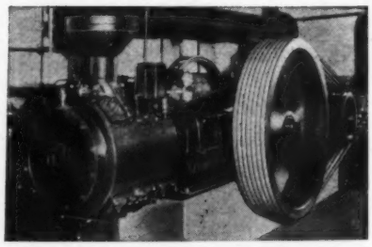
Cushioned duo-plate valves eliminate valve breakage — actually grow tighter with use.

"The Dependable Operation of Our GARDNER-DENVER 'HA' Compressor Is Second to None"

● Gardner-Denver Class "HA" Two-Stage Horizontal Air Compressors have established a reputation for sustained high efficiency and low operating costs that is *second to none.* Under widely varying operating conditions—in all sections of the country—they have fully proved their ability to provide plenty of air at low cost.

Why? Among the many answers is the fact that Gardner-Denver Compressors are equipped with control apparatus that automatically fits the output to the amount of air required. Where the requirements are less than full capacity, the compressor is automatically adjusted to deliver 75%, 50% or 25% of capacity. This results in sizable savings. You don't pay for unnecessary power when air requirements are low, while, at the same time, you are able to get all the air you require when operating at peak capacity.

Assure *your* plant an unfailing, economical air supply for the busy months ahead. Write us for complete facts about Gardner-Denver "HA" Air Compressors. Gardner-Denver Company, Quincy, Illinois.



An inadequate air supply was tying up operations in the spray booths of a large midwestern plant. The trouble vanished when two small, vertical compressors were replaced by this Gardner-Denver RX Single-Stage Horizontal Compressor. The user reports that with the RX, his current costs are actually lower for a larger air supply.

GARDNER-DENVER SINCE 1859

Steel- FIRST LINE OF NATIONAL DEFENSE

Republic Operates the World's Largest Stainless Steel Finishing Mill—

Ten years ago, Republic operated the world's largest stainless steel finishing plant. Each year it seemed to become smaller as ENDURO Stainless Steel found its way into new products—automobiles, trains, airplanes; chemical, textile and food processing equipment; home appliances and even fine jewelry.

Actually, the plant has been enlarged—now covers five acres of floor space—and much new finishing equipment has been added so that, today, Republic still operates the largest stainless steel finishing plant in the world.

Now, to the huge peace-time need for ENDURO for a wide variety of every-day uses is added the demand of industry working feverishly in the defense of America—for bomb chutes in planes, galleys in naval craft, floats for flying boats and a host of other uses where high strength and heat- and corrosion-resistance are imperative.

Republic has looked ahead—has expanded all its facilities—and, fortunately for every man and woman interested in preserving our freedom, is able and anxious to help in the crisis that now squarely faces America—with more and better ***steel—first line of national defense.***

The line of steels and steel products manufactured by Republic is so diversified that we have prepared a complete listing in Booklet No. 199. A copy will be sent you upon request.

REPUBLIC STEEL CORPORATION • CLEVELAND, OHIO

BERGER MANUFACTURING DIVISION • CULVERT DIVISION • NILES STEEL PRODUCTS DIVISION
STEEL AND TUBES DIVISION • UNION DRAWN STEEL DIVISION • TRUSCON STEEL COMPANY

Yes Sir - - THIS DRILL'S Engineered for HEAVY DUTY PRODUCTION LINE USE

VAN DORN'S ¼" HEAVY DUTY DRILL

is designed end-to-end for real *heavy duty* service, built to stand continuous production use, powered to keep turning in hardest steel. Light weight and perfect balance reduce fatigue. Bits changed in an instant—the Portomatic keyless chuck with patented gear locking pin is the secret (available also with Jacobs geared chuck). Instant release trigger switch and trigger guard mean perfect control. And the spline mounted spindle gear and spindle bearings, with inner and outer races locked in place mean long, trouble-free life—more drill for your dollar! Phone your jobber now and let him demonstrate how Van Dorn's ¼" Heavy Duty Drill takes the kinks out of production drilling—or write Van Dorn Electric Tools, 719 Joppa Road, Towson, Md.

"Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

THE "RED HEADED" PORTABLE ELECTRIC TOOLS

Knudsen Warns Against the Friday to Monday Blackout

(*Continued from page 83*)

willingness to mediate any difficulty before resorting to strikes, but I have also faith in labor's acceptance of the spirit of fair play and the necessity for avoiding discrimination against industry equally as unfair as discrimination against labor. I cannot regard our people as divided in essential interest so that we should consider labor and industry, or any other groups, as other than parts of a compact national body. I cannot believe that either needs to be coerced or purchased, in the invidious sense. I believe all will do as I intend to do: Obey the orders of the Chief Executive and the laws enacted by Congress, as construed by the courts, and help to prove that a free people are capable of self-discipline and of productive work superior to that of a dictator's subjects.

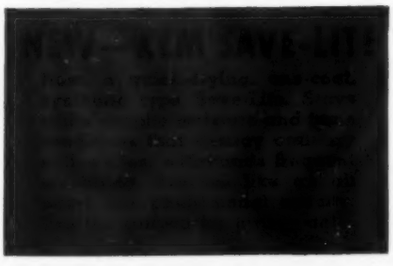
Can Get Action

Down in Washington we are asked if we can do a lot of things. Some of them we can do and some we can't, but I can assure you of this, that the group I work with on the Defense Commission will do everything that is humanly possible to smooth out whatever little difficulties you might have in the execution of your defense orders. We represent you. We are down there—you have the work in your plants. We hear a lot about what is called "red-tape," which is another name for cumbersome procedure, but in justice to the top officials of the Army and the Navy we can generally get action when requested. We are there to give you assistance in every way we can. All we ask is, give us speed and more speed. Full-time operations of all machines. Talk to your men—make them feel that it is their responsibility as well as yours. Ask them what they think of a civilization that drives women and children to live in cold and wet holes in the ground. We have gone back a thousand years in the last year. Why? Because a few individuals decide the actions of totalitarian nations and democracy is fighting for its life. It makes one shudder to think that brains can devise a situation like this—where we kill the harmless because we want to break the spirit of the people. Let us work and work harder so that the possibility of such barbarism spreading to our shores will be an impossibility forever.

We are, to my mind, way beyond worrying about the cost; about the

Paint away gloom with SAVE-LITE!

Frankly, we're exaggerating. Few plants are so gloomy that a girl wouldn't notice her own cousin. But many workers *do* strain their eyes, make mistakes and tire quickly—all for want of a high light-reflecting paint on walls and ceiling!



For example, one Massachusetts plant raised their floor-level light by 125% with one coat of super-white Save-Lite. An Ohio factory increased lighting levels from 6 to 17 foot-candles with Save-Lite. Standard tests show that an unpainted brick wall gives a reading of one foot-candle, a gray wall 4 foot-candles, and a Save-Lite-painted wall 22½ foot-candles. For Save-Lite actually reflects more light than many silvered mirrors!

Think what this new brightness would mean in your plant—in more and better work, fewer errors, less eye-fatigue, better housekeeping and all-around cheerfulness. And this new brightness is yours with no change in lighting fixtures or load . . . is yours at a cost little higher than a cheap, slap-dash paint job!

Get the facts on Save-Lite—made only by Sherwin-Williams. When you see how it transforms your plant, you'll say, "Why didn't we do this years ago!" Send the coupon to Sherwin-Williams Co., Cleveland, Ohio. Also in all principal cities.

SHERWIN-WILLIAMS

SAVE-LITE

THE SHERWIN-WILLIAMS COMPANY
101 F. Prospect Ave., N. W., Cleveland, Ohio

Please send me complete details on factory painting with Save-Lite. No cost or obligation.

Name.....

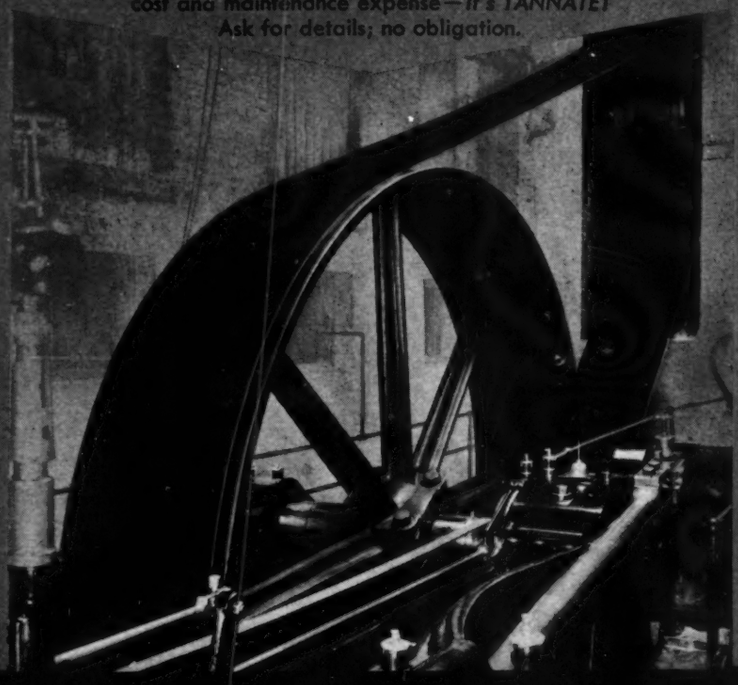
Company.....

Address.....

Of a TANNATE Belt installed on an engine 17 YEARS AGO this plant superintendent says:

"It's still in Good condition . . . running O.K. . . . good for years yet!"

Take this hint! If you are looking for belting that increases production—and decreases unit cost and maintenance expense—*It's TANNATE!* Ask for details; no obligation.



STEP UP PRODUCTION WITH

RHOADS Founded 1702

Tannate

WATERSHED LEATHER BELTING

J. E. RHOADS & SONS · 35 N. SIXTH ST., PHILA., PA.

NEW YORK · CHICAGO · ATLANTA · CLEVELAND

laws we think we ought to have and the way we are going to live when this is all over. The important thing now is to get this job done or as much more of the job done as is required permanently to protect our standard of living and our institutions, our freedom and individual opportunities.

We Show Customers' Operators How

(*Continued from page 86*)

rium, the question of whether the men attend or not is entirely up to them. It is quite interesting to note, however, that in such cases attendance is almost as large as when the lecture is held in the plant on company time.

In planning distribution of the manual, we debated for a long time whether or not to charge operators for it. In this connection recovery of part of the cost of preparation was an extremely minor consideration. We are not in the publishing business and had no intention of producing a book for sale, in the ordinary sense of the word. Furthermore, our preparation costs in terms of the time and effort spent by our engineers, not to mention printing costs, were such that the very idea of intending to relate the price charged to costs incurred was ridiculous. We were interested in developing better turret-lathe operators—not in peddling a book.

For Those Interested

However, we finally decided to charge $1 for the manual. The reason was this—it is only human nature to consider something given away as something of little value or importance. Conversely, if a man considers an object worth buying with his own money, he will be inclined to respect his purchase and make real use of it. Another consideration was the element of possible waste. To give this manual away to men who might never even look at it, would be extravagance. By charging for the manual we were assured that only those men who were actually interested in studying it would get it. Others would not pay for it.

In many cases we have had to explain this line of reasoning very carefully to employers who want to purchase these books by the score to give to all their turret-lathe operators.

The net result of this policy has been that the great majority of the books thus far distributed have been bought and paid for by the operators themselves.

The men are told about the manual during the lecture, order blanks in the

BOSTITCH

MAY STEEL-STITCH YOUR PRODUCT, 3 TIMES FASTER, AT 1/3 THE COST

Motor-driven Bostitch Machines drive wire stitches through steel sixty one-thousandths of an inch thick, at a machine speed of 295 per minute! Making their own stitches from a coil of wire, they are often more than 3 or 4 times as fast as riveting or other methods.

Typical examples of the use of Bostitching on modern assemblies.

A LITTLE STITCH OF STEEL ... BIG SOURCE OF ASSEMBLY SAVINGS

Many manufacturers have saved thousands of dollars in assembly costs by installing Bostitch automatic staplers and stitchers not only to stitch steel to steel but also to fasten steel (or other metals) to wood, leather, fibre, cloth, rubber — which cannot be welded or fastened so securely with rivets or by any other method. Investigate Bostitching! The coupon below will bring you facts about savings and product improvements made in your industry.

BOSTITCHING:

Using the right machine and the exact size and kind of staple to get the most efficient fastening results.

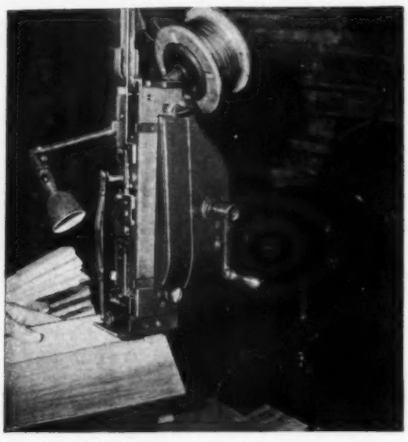
Only Bostitch can offer you nearly 800 models of stitchers and staplers, from which to select the right machine for your particular needs. More than 300 representatives, in more than 100 U.S. and Canadian cities, and 18 research engineers will help you adapt Bostitch machines and methods. Liberal rental, trade-in and budget plans make it easy to start with a small investment in Bostitch machines and progress economically to a complete installation.

Fastening Metals to Wood, Leather, Rubber, Fibre or Cloth.

While stitching through steel has recently come into prominent use in the automobile industry, management as a whole is only gradually coming to realize the importance of stitching and stapling machines to speed the efficient assembly of many different parts and materials.

Perhaps the most striking and simple example of the growing use of stapling machines is the quick, efficient Stapling Hammer and Tacker now in common use to fasten steel insulation in roofs and attics. This is only one instance, however, where stapling or stitching machines (Bostitching) have benefitted the building materials industry. (See cut below).

The same fastening method has saved time and money in such varied operations as these: fastening *leather* and steel in the manufacture of a bicycle tool kit; stitching metal side plates on cloth buffing wheels; stapling cloth and wire mesh to a wire handle in the manufacture of a flyswatter; stapling *felt* innersoles into wooden-soled work shoes—and many other Bostitching achievements, too numerous to list in full.



Cutting Hours down to Minutes

Bostitching goes to work to stitch these shingle corner pieces for hips and ridges of roofs, saving the hours of laborious work which were formerly necessary. Picture shows a Bostitch Model 148 Stitcher in action. It makes its own staples from a coil of wire.

BOSTITCHING—

Its Unique Advantages

1. *Engineering service.* Nearly 800 different machine models are available from this largest manufacturer of staplers and stitchers. A force of research engineers is ready to adapt them to new needs, or to solve entirely new problems by the Bostitching method.

2. *Common-sense financing.* Bostitch customers are able to get the right machines for present production requirements, then trade them in for faster, larger models as production grows. Rental and budget plans further eliminate investment risk. For complete details, address Bostitch, 60 Division Street, East Greenwich, R. I.

(Advertisement)

WRITE FOR THIS FREE FOLDER — OR SEND SAMPLES TO BE FASTENED

BOSTITCH 60 Division St., East Greenwich, R. I.

Send free copy of Folder, "Bostitch Fastens It Better With Wire," containing fastening facts for my industry.

Name .....

Company .....

Address .....

My Industry 1-41

(In Canada, Bostitch-Canada, Ltd., Montreal)

BOSTITCH

fastens it better with wire

STAPLING · STITCHING · TACKING

BLITZKRIEG on INJURIES!

Eliminate them—as a patriotic act and for economy of time and money.

Our line of protective clothing can be of utmost assistance to you.

HELMETS—7 styles.
COATS—26 styles.
LEGGINGS—20 styles.
GLOVES & MITTENS—Over 100 styles.
APRONS—24 styles.

(The above items made of Asbestos, Leather, Fireproofed Duck and Rubber.)

In addition we carry a complete line of industrial safety equipment.

NEW 48 PAGE CATALOG No. 40
Packed with information about all kinds of injury-preventing safety clothing and safety devices. Write for a copy.

This suit made from asbestos—Helmet No. 260—Coat No. 752—Leggings No. 515—Gloves No. 174.

SAFETY *Clothing and Equipment* CO.
7016 EUCLID AVENUE · CLEVELAND, OHIO
Phone Endicott 1722

COSTS LESS *Because* **IT'S BOMB PROOF**

This Is ForgeWeld
Designed to be unbreakable—to carry loads of 6,000 to 8,000 lbs. per set of 4. The top plate (½" thick at stresspoints) and king bolt (1" diameter) are one . . . drop-forged from a single piece of SAE 1045 steel . . . Genuine Hyatt roller wheel bearing turns on a 1" SAE 1045 axle. Sizes, 5" to 12" wheel.

Yes, practically immune to shock—bump-proof! —and costs LESS, even if the price is more than ordinary casters. On your trucks, dollies or portable equipment this caster will still be giving *like-new performance* when cheaper casters would need replacement.

Write for Free Plant Survey

SERVICE CASTER & TRUCK CO., 505 N. Brownswood Ave., Albion, Mich., **Eastern Factory:** 434 Somerville Ave., Somerville (Boston), Mass., **Toronto, Canada:** United Steel Corporation, Ltd., S. C. & T. Co. Division.

SERVICE
Casters & Trucks

form of envelopes are available on the table. Operators who are interested pick up these envelopes and take them home. Whoever decides he wants a manual simply puts a dollar into the envelope and mails it to our office.

3. Product

So much for the equipment used and the way in which it has been put into operation. Now what about the product? Have we really helped to produce more effective work on the part of turret-lathe operators?

Naturally we cannot give a categorical answer to this question. We know, however, the extent to which this program has already developed.

The circulation of "Blue Chips" is now over 18,000, and more than 7,000 copies of the operator's manual have been distributed, at one dollar each, to actual purchasers.

We have two men devoting full time and three men devoting part time to the presenting of our slide film, lecture, and charts in customers' plants. Up to September 1 we presented this program to over 300 meetings with a gross attendance of about 17,000. And we have received dozens of letters from executives thanking us for the service.

It is significant that we have been asked to repeat our program in a number of plants. One company has actually asked us to present our program 16 times. Production executives, therefore, apparently believe that it is getting results.

As to the operators themselves, we can only judge by their reactions to the program and their interest in the manual and in "Blue Chips."

After the lecture there is a brief period for questions. We are interested in the fact that these questions are always specific. This is a typical question: "In finishing SAE 1,050 steel with a high-speed steel cutter, what kind of a radius should be ground on the cutting edge?" Another significant fact is, of course, that so many of them ask to be put on the mailing list for "Blue Chips" and pay their dollars to get a copy of the operator's manual.

Our experience with turret-lathe operators convinces us that these men take their jobs seriously, and are anxious and eager to get any help that will enable them to become even better workmen. They want to be "tops." They want to turn out the most production in the least time. They want the quality of the work they turn out to be up to the highest possible standard.

In the course of a lecture we find time and again that these men are literally sitting on the edge of their chairs. A lot of the ground we cover may be "old stuff" to many of them—and yet they don't want to miss anything. We

"IT'S A HORSE ON YOU!"

Says Simon Degree

STOP HIM WITH MODINES

Simon Degree has a horse. It's a "wooden horse." He uses it as a subterfuge to get into factories and offices. Once in, he's the *four* horsemen—Trouble, Cost, Delay, and Loss—all in one.

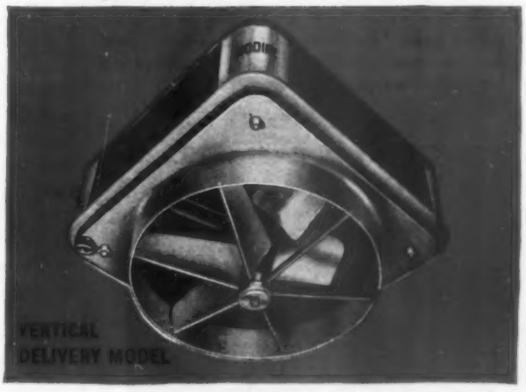
To the unsuspecting, an inefficient heating system is another Trojan Horse. Simon Degree is hiding inside it. He is *inadequate heating*—the enemy that bores *from within* secretly sabotaging production.

If you are to push production to the new peaks demanded by national defense requirements—your heating must not be a hindrance. It must be a help. That calls for planned productive heating *with Modine Unit Heaters.*

Modine Heating—A Proved Production Asset

With Modines you *automatically* get heat *when* you need it—*where* you want it—warming working areas and floors. You get Modines' faster warm-up, uniformly effective heat distribution, even temperatures. Workers are kept comfortable and contented; lose less time through illness. There are no cold weather shut-downs in any part of the plant.

Are you expanding your plant facilities—building a new plant, or modernizing an old one? Then protect your production and profits with Modine *proved precision heating* and Modine *three-way saving*: in installation, operation, maintenance. And Modine *prompt delivery* will save you time, too. *Get details and Modine literature.*



A Modine representative's name is in your phone book — "Where to Buy It" section under Heating Apparatus.

More Modines Are Sold Than Any Other Unit Heater

modine

THE UNIT HEATER WITH THE BUILT-IN SAFETY FAN GUARD

MODINE MANUFACTURING COMPANY, 1730 RACINE ST., RACINE, WIS.

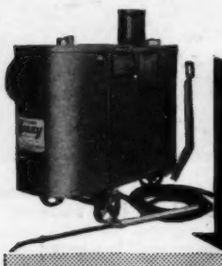
RELIEVE YOUR SKILLED LABOR "bottle-neck"

with

HYPRESSURE JENNY STEAM CLEANER

Dirt and grease on operating equipment, tools, materials, floors, and windows waste 25% to 40% of your skilled mechanics' time, and definitely retards National Defense Production! Hypressure Jenny Steam Cleaning relieves the skilled labor "bottle-neck"—saves 15 to 25 minutes out of every man-hour on machinery repair work; removes grease and dirt from semi-finished products 8 to 10 times faster; and helps keep equipment running efficiently by revealing cracked or worn parts in time to prevent costly shutdowns. Let us show how Hypressure Jenny can relieve the skilled labor "bottle-neck" for you—and save you real money in the bargain. No obligation for requesting our free Survey today!

HOMESTEAD VALVE MFG. CO.
P. O. Box 86 CORAOPOLIS, PA



MAIL TODAY

CLIPPING A COUPON LIKE THIS SAVED ONE MILL $4500 ANNUALLY!

O.K.—Send that FREE SURVEY based on our figures inserted below.

Number
..... men employed in maintenance.
..... pcs. machinery cleaned monthly.
..... sq. ft. windows cleaned yearly.

Name.....
Address.....
.....

have yet to find a group of operators who acted as if they knew it all or who were not anxious to learn more.

So, as to net results, we hope and we believe that this program is leading toward important accomplishments. How important such accomplishments may prove today with the country getting started on a tremendous armament-building program, may be illustrated by a simple set of figures.

There are today in the United States about 55,000 turret-lathe operators. Suppose that on the average the productivity of these operators could be increased by only 5 percent, that the production of a man turning out 20 parts per day, for example, could be increased to 21.

This would represent an increased production equivalent to that now being turned out on 2,750 turret lathes.

In other words, if productivity on present lathes could be increased just 5 percent it would relieve the pressure for new turret lathes by an amount which not so many years ago represented a whole year's output in the industry.

The Future of America

(*Continued from page* 83)

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fenses; and, second, *to prepare for the future,* in both its immediate and long-range aspects.

I. Safeguarding Our Freedom

1. *What We Need to Protect*—We Americans intend to remain a free nation of free men and women. We have faith in constitutional representative democracy, in private enterprise, and in civil and religious liberty as the inseparable fundamentals of our freedom.

Freedom, as we Americans know it, means that we may attend any church we prefer; elect our government representatives in free elections; say and write, hear and read what we please; live and work where we will; invest our savings in a home, in a neighborhood shop, in a corporate enterprise, or however else we choose. Such liberties as these are the most precious heritage of every American.

To safeguard our independence as a nation we must build our military, economic, and spiritual defenses on a foundation of strong and united purpose; but in building these defenses we must hold fast to the liberties that are the very foundation of the American way of life.

2. *Providing Our Military Defenses—*

EXTRA VALUE FEATURES IN
Darnell
CASTERS & WHEELS
These durable, precision-built Casters assure the easy handling of heavy loads. Savings in floor and equipment wear soon pay for their cost.
DARNELL CORP., LTD.
LONG BEACH, CALIF.
36 N. CLINTON, CHICAGO
24 E. 22nd ST., NEW YORK
QUALITY FIRST!

"IT'S 9 TO 1 YOU'RE LOSING MONEY NOW"

Authorities agree that nine out of ten industrial plants in the country are in need of new wiring. Nine out of ten plants are losing money today through invisible power losses . . . power losses arising from antiquated, worn-out equipment, overloading or failure to provide adequate wiring for new equipment. Is your plant one of them?

Better check up now. Electrical failure... plant breakdown and consequent loss of output is even more expensive. Call in your maintenance man or electrical contractor and go over the problem of your plant's wiring. Better yet, ask us to send you our Industrial Wiring Survey and Industrial Wiring Guide. The Survey will tell you how to check your electrical circuits; and the Guide will show you what to do about the conditions you find.

Both are insurance against electrical failure . . . and whopping big repair bills. So, don't take chances...especially when those chances are 9 to 1 against you. Write for *free* copies of the Industrial Wiring Survey and the Industrial Wiring Guide now!

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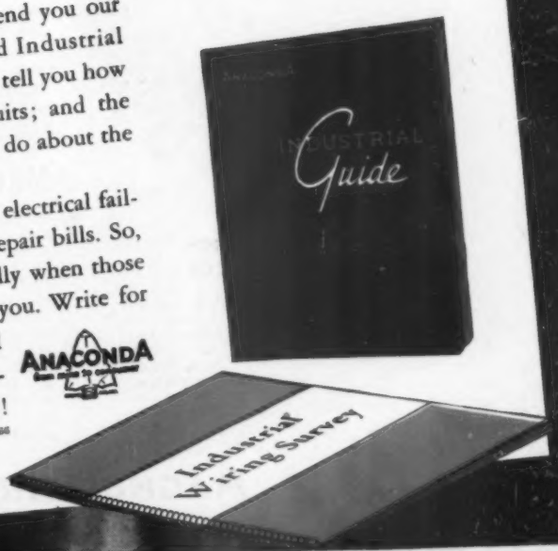


ANACONDA

USE MODERN IMPROVED **Anaconda Wire & Cable**

ANACONDA WIRE & CABLE COMPANY, General Offices: 25 Broadway, New York City; Chicago Office: 20 North Wacker Drive

A Subsidiary of Anaconda Copper Mining Company. Sales Offices in Principal Cities

Keep Production Up

The production demands of the day call for keeping the men on the job! . . . Halsey Taylor fountains do their share to keep workers satisfied and production up, because they give you a constant source of water supply that's always health-safe! Patented Halsey Taylor features promote convenience and sanitation.

•Get our complete catalog, showing factory and office drinking fountains, as well as ice and electric coolers. Write!

THE HALSEY W. TAYLOR CO., WARREN, O.

Halsey Taylor
DRINKING FOUNTAINS

Really Clean Cement Floors

3¢ Per 100 sq. ft.

Even when you soak them overnight — then laboriously scrape and scrub them the next day, you don't get really clean cement floors with ordinary cleaners. And you can't afford to take chances with inflammable gasoline or other volatile solvents.

Use safe—sure—*economical*—

MAGNUS CEMENT CLEANER

It quickly penetrates grease and oil—down to the cement surface and deep into all cracks. Even the heaviest accumulations quickly yield to this cleaner. No soaking, scrubbing or scraping. Flushes clean with an ordinary hose.

More—it hardens and whitens the cement, adding service life as it cleans. And it's not only non-poisonous but contains no free alkali.

Magnus Cement Cleaner is cheapest to use too, compared with ordinary cleaners, such as alkali or soap powder, gasoline or creosote type solvent cleaners.

For really clean floors at lowest costs—use Magnus Cement Cleaner.

PERFORMANCE IS THE PROOF

We have just issued a collection of performance reports on Magnus Cement Cleaners and Magnus Cleaners for other types of floors—linoleum, wood, tile, etc. It makes interesting and helpful reading. Write for your copy.

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleansing Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants

220 South Avenue Garwood, N. J.

Magnus CLEANERS

The strength to defend America is the first concern of this nation. Three major problems are involved:

(1) To determine the vital interests to be defended, and how far beyond our continental borders these interests extend. This is the responsibility of government.

(2) To determine the nature and size of the military establishment, and the equipment and supplies required. This also is the responsibility of government.

(3) To produce the required equipment and supplies. This is the task of industry—of America at work.

Production of the equipment and supplies required for defense has been entrusted to the individual industrial enterprises of America, whose productive ability is demonstrated by the fact that this is the greatest of industrial nations.

The manufacture of planes, warships, guns, and many other kinds of munitions and equipment has created a demand for new machinery, new tools, and new skills, to which the individual industrial enterprises of America are applying their full initiative and resourcefulness.

American industry is undertaking its task.

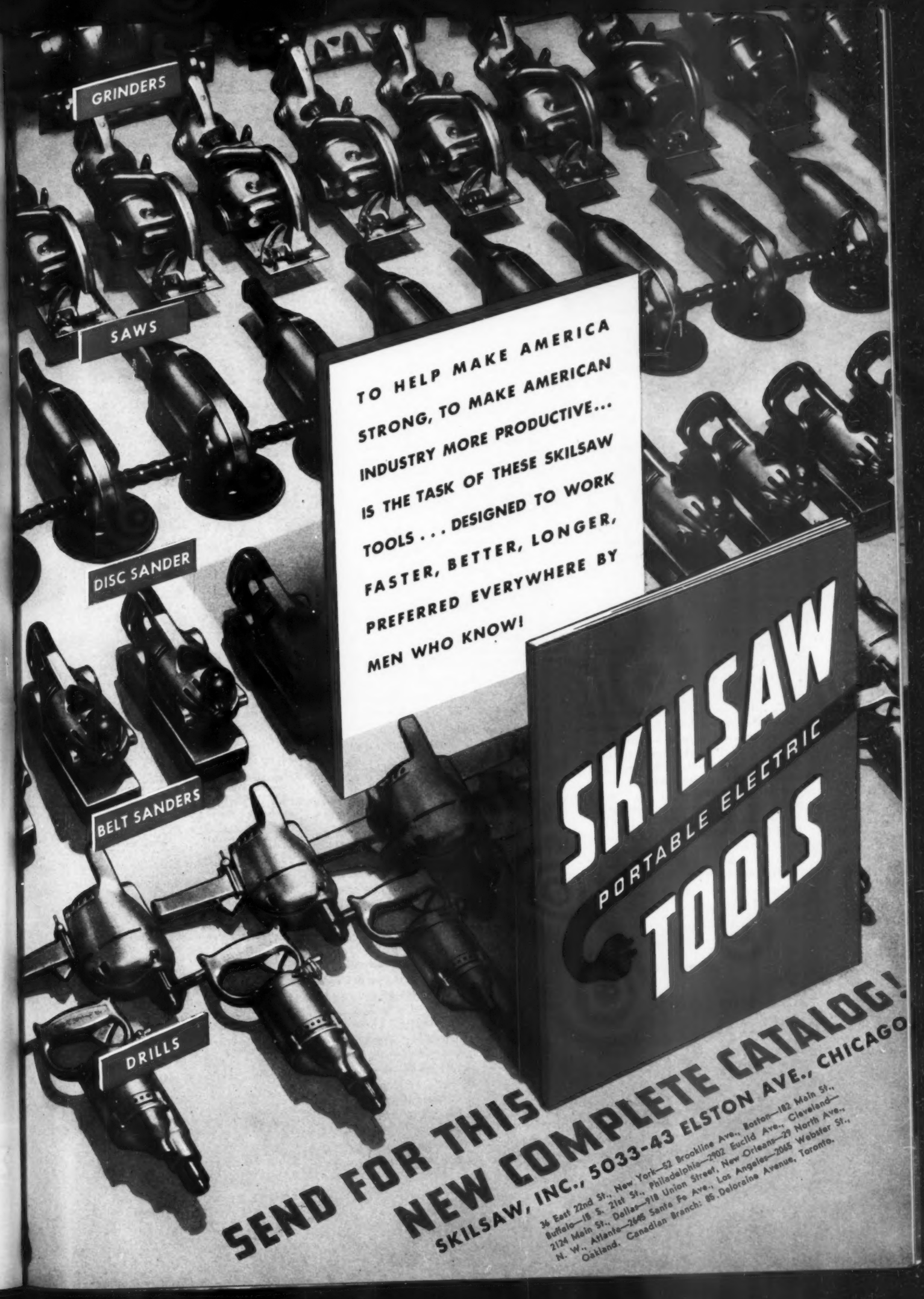
3. *Strengthening Our Economic Defenses*—Our economic machine must be geared to the production of both the equipment needed for national defense and the goods needed for everyday living.

For several years prior to the outbreak of war in Europe, the totalitarian countries had been using a large part of their resources for armament purposes. Confronted with the necessity of increasing even further their production of war materials, they were forced to restrict still more drastically the production of goods entering into their standards of living.

To Make the Nation Secure

In this country, in contrast, we start our armament production for national defense with ample natural resources, with unemployed but employable men, with an expansible plant capacity, and with idle capital, all of which can be put to use not only to make the nation secure against external dangers but also to work at the task of producing the goods and services needed for normal living conditions.

National defense is national insurance. The American people can secure this necessary insurance without experiencing a reduction in their standard of living to the extent suffered abroad. But the effort to maintain the American living standard at its present level can hold hope of success only if labor, capi-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TO HELP MAKE AMERICA STRONG, TO MAKE AMERICAN INDUSTRY MORE PRODUCTIVE... IS THE TASK OF THESE SKILSAW TOOLS . . . DESIGNED TO WORK FASTER, BETTER, LONGER, PREFERRED EVERYWHERE BY MEN WHO KNOW!
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36 East 22nd St., New York—52 Brookline Ave., Boston—182 Main St., Buffalo—18 S. 21st St., Philadelphia—2902 Euclid Ave., Cleveland—2124 Main St., Dallas—918 Union Street, New Orleans—29 North Ave., N. W., Atlanta—2645 Santa Fe Ave., Los Angeles—2045 Webster St., Oakland. Canadian Branch: 85 Delorraine Avenue, Toronto.

On Duty . . . in Uniform!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

NOT so long ago, "national defense" meant, to most of us, a few thousand soldiers and sailors. We went about our business, relying on a relatively small body of "specialists" to defend our shores against aggression.

That concept has gone the way of the smoothbore musket. Today, national defense is a program in which *all* of us must take part.

American industry has already rolled up its sleeves and is ready to meet the challenge of producing — speedily and efficiently—those goods which are vital to national defense. In meeting that challenge, industry faces many problems — and, among them, none more serious than a shortage of *trained manpower!*

To help industry solve this problem (and solve it *fast!*) the International Correspondence Schools — whose apprentice, adult and group training clients include nearly 3000 large and small business and industrial concerns, and several branches of the United States armed forces—now make available a SELECTED UNITS TRAINING PLAN which *shortens training time by months,* and is adaptable to almost any industrial training problem!

We are ready to discuss, intelligently and constructively, the application of this proved plan to *your* training problems.

Write, wire or telephone to Cooperative Training Division I. C. S., Scranton, Penna.

International Correspondence Schools SCRANTON, PENNA.

OFFICES IN ALL LEADING CITIES IN THE UNITED STATES, and Montreal, London, Sydney, Wellington, Cairo, Shanghai, Havana, Honolulu, Mexico City, Buenos Aires, Manila, Cape Town

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

tal, and management work together with a united purpose for production, more production, and still more production.

Among the fundamental conditions necessary to this end are:

(1) An equitable relationship between the prices of agricultural products and the prices of other commodities;

(2) Opportunity for industrial management and labor to operate efficiently and effectively in the processes of production and distribution;

(3) Taxation carefully and intelligently adjusted to meet at least non-defense expenditures, and designed to facilitate the flow of private capital and remove uneconomic barriers to the production and distribution of needed goods and services;

(4) Avoidance of production by government of goods which private enterprise can furnish;

(5) Recognition of the value of the profit motive as a powerful incentive to productive effort, and of the economic need for profits in industry sufficient to maintain and expand productive enterprise;

(6) Maintenance of such equitable wage rates and conditions of employment as will promote increased production and employment and a higher actual income to workers;

(7) Encouragement of the investment of private capital in production, research, and continued economic venture;

(8) Preservation of competition as the best assurance to the consumer of reasonable prices and high and improving quality of product; and

(9) Maintenance of the buying power of consumers by all possible improvements and economies which will reduce costs of production and distribution.

Healthy industry is as essential to the production of adequate military equipment and to the maintenance of the American standard of living as are healthy men to an efficient army and navy.

4. *Fortifying Our Moral and Spiritual Defenses*—Essential to America's defense effort is the moral and spiritual strength of the people. There must be a resurgence of faith in God and country, of confidence in each other and in ourselves; there must be self-reliance and a willingness to sacrifice immediate self-interest for the common welfare. These have been outstanding American qualities in all our history.

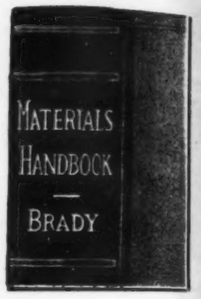
Where dictators rule, they have tried to create national pride and zeal and to induce united action in their peoples by absolute control of sources of information, prevention of free discussion, and suppression of civil liberties. These are means that would never be tolerated in the United States.

In the free society which this nation is arming to defend, we can in our American way strengthen the moral and spiritual vigor, the purposeful unity, that have carried us through other crises and are needed now more than ever.

The American people are awakening

PRACTICAL DATA ON 5000 MATERIALS AT YOUR FINGERTIPS

Save endless time through the use of this handbook for preliminary survey when you need materials. Easy to consult; gives the most helpful facts on kinds, properties, uses, sources, for thousands of natural and synthetic materials needed by purchasing agents, product engineers, factory executives, etc.



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591 pages, 6 x 9, $5.00

In this book you will find just the facts you want to enable you to estimate, specify, purchase materials more easily, more intelligently, more economically. More than 5000 materials are covered—with regard to relative quality, composition, strength, weight,—whatever facts are necessary to give a quick, practical, authoritative picture of the place of the material in industry. Saves time, eliminates error in the investigation and choice of materials for manufacturing, construction, engineering, and processing.

Find the material you need, when you need it, in such groups as:

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Finishing Materials, Pigments, Solvents
Foundry Alloys and Materials
Heat-treating Materials
Industrial and Plating Chemicals
Lubricants, Oils, and Greases
Minerals
Molding Materials, Gums, Waxes
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The RIGHT material for your purpose . . . What is it? What are its properties and uses? How does it compare with similar materials? See this encyclopedia for quick, dependable information. Try it out 10 days on approval. Just send the coupon, today.

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This great new General Motors plant is completely equipped with Bull Dog BUStribution DUCT and Universal Trol-E-Duct. When machinery is brought in and placed, light and power are instantly available anywhere.

The Blue Chip producers in defense production are users of Bull Dog flexible light and power systems

Fast production is the battle cry today! And if you look inside the key plants that are producing for America's defense, you will find Bull Dog flexible light and power distribution systems on the job.

A list of the users of these Bull Dog systems is an honor roll of the nation's greatest manufacturers. This isn't just coincidence. Industry has found that Bull Dog systems—BUStribution DUCT for power, Universal Trol-E-Duct for light, and Industrial Trol-E-Duct for portable tools or moving "loads"—are an immense asset in gaining uninterrupted speed in production.

With these Bull Dog distribution systems you can build a new plant today — or lease one — without waiting to figure exactly where either light or power need be. You can move in — and tap right in for light or power *wherever and whenever needed.*

Regardless of any later re-grouping or additions of machinery, instant current is available without rewiring. Both BUStribution DUCT and Trol-E-Duct are completely salvable—thus providing means, at minimum outlay, for expansion in any form.

Write for descriptive illustrated bulletins on Bull Dog flexible electrical distribution systems and how they help you speed up production and save money.

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ELECTRIC PRODUCTS CO.
DETROIT, MICHIGAN
Bull Dog Electric Products of Canada, Ltd., Toronto, Ontario

MANUFACTURERS of Vacu-Break Safety Switches, Panelboards, Circuit Master Panels, Switchboards, Duct Systems—FOR LIGHT AND POWER

ATHLETE'S FOOT

impairs the efficiency of 50% of your employees

U. S. Public Health Service Bulletin (R-674) states that 50% of all adults are afflicted with Athlete's Foot. Shower rooms are primary spreaders of the infection. But also your shower rooms offer your best opportunity to control it, regardless of where your employees contract it.

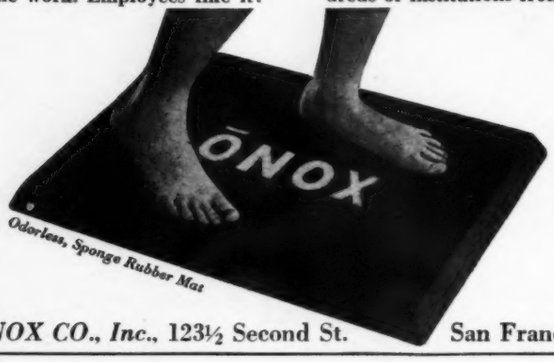
New way to solve problem

Recent research has upset former theories on control of Athlete's Foot. The new procedure is revolutionary—the ONOX method. A safe non-poisonous skin toughener does the work. Employees like it!

You may test it under any conditions you choose to impose and without obligation. For example:

● ***We will ship prepaid, your trial order for any amount of ONOX and equipment. Use it for 60 days. If at the end of that time ONOX has not proved itself to your complete satisfaction (100%) you owe us nothing and return nothing. This offer is open at any time to established industrials.***

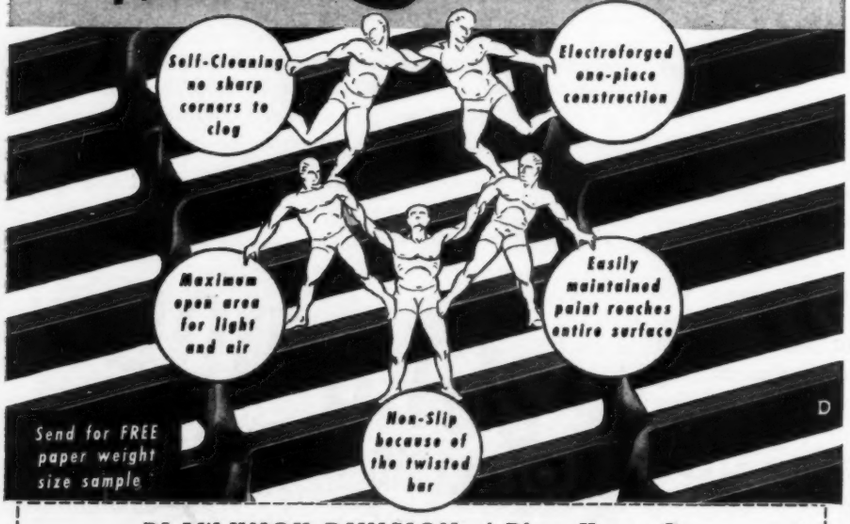
We would like to send you the details of the simple ONOX method. Used by hundreds of institutions from coast to coast.



ONOX CO., Inc., 123½ Second St. San Francisco

BLAW-KNOX GRATING

PRESENTS 5 OUTSTANDING FEATURES


Self-Cleaning no sharp corners to clog
Electroforged one-piece construction
Maximum open area for light and air
Easily maintained paint reaches entire surface
Non-Slip because of the twisted bar
Send for FREE paper weight size sample
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to a common appreciation of what they have to defend, stirred to a common zeal for defending it, inspired with a common patriotic devotion. We are all ready to travel the hard road, if need be, to assure the continuance of the American way of life.

II. Preparing for the Future

In preparing for national defense and while endeavoring to maintain normal economic life, the American people are concerned also with what lies further ahead.

1. *When Peace Comes*—The time will come when millions of workers engaged in producing goods for national defense will be released from that employment; when a large army of young men will have completed their military training; when the support provided by the defense program to employment in non-defense occupations will cease. In other countries similar conditions will exist, the effects of which upon this nation's domestic and foreign markets should be anticipated.

Consistent with the maximum defense effort itself, the policies and practices followed during the existing emergency by business, labor, agriculture, and government should be such as to lessen the dangers of a post-war depression or cushion the effects if one should occur.

Among such fundamental considerations are protection of government credit, by keeping reserves of borrowing power for future use if needed, and by encouraging the use of private funds for productive defense facilities; prevention of an inflationary spiral of runaway prices and wages; curtailment by industry of any tendency to over-mortgage the future or to build up inventories unnecessarily, by unwise expansion of credit through installment selling or otherwise; efficient expenditure of defense funds; and rigid economy in non-defense expenditures of federal, state, and local governments.

Such measures would not delay or obstruct armament production; yet they would contribute much to preventing a subsequent economic depression.

2. *The Longer View*—America has been built to its present stature by the free enterprise and individual initiative of its people.

Fifty years ago our geographic frontiers had disappeared. We found that new industrial frontiers offered opportunity for even greater expansion. There are other industrial frontiers before us today still more extensive, still more promising.

Here in America we have an abundance of natural resources, of manpower, of machines, of capital, of organizing and technical skill.

Inventors' workshops and research

laboratories are constantly supplying new things that create new jobs and contribute to a higher standard of living as they are developed into commercial products.

The main assurance of the future welfare of America lies in the present and potential wants of the people and in the ability of free enterprise to provide the goods and services the people desire.

Today and for the future, the American people want strength and security, built upon the freedom of individual opportunity. It is this freedom of opportunity that has served America so well in the past; that can make the nation strong and secure in the existing crisis; that can bring security to the individual in the years ahead, in such measure as his individual effort can achieve.

Our heritage and our vision is a free, happy, industrious America—a vital, dynamic America of self-reliant individuals. It is a heritage which Americans acting together can preserve and enlarge. It is a vision which Americans working together can realize and fulfill.

Pledge

The 1940 Congress of American Industry reaffirms *Industry's Program for American Progress* and the *Declaration of Principles Relating to the Conduct of American Industry*, adopted by this Congress in 1938 and in 1939, and further pledges itself:

1. To continue to defend against attack from any source the American concept of freedom—constitutional representative democracy; private enterprise; and civil and religious liberty, including freedom of speech and freedom of the press;

2. To exert its utmost effort in cooperation with the government to carry out the program of national defense with all possible speed and efficiency;

3. To maintain at the same time, as far as possible, production of goods and services to meet normal needs;

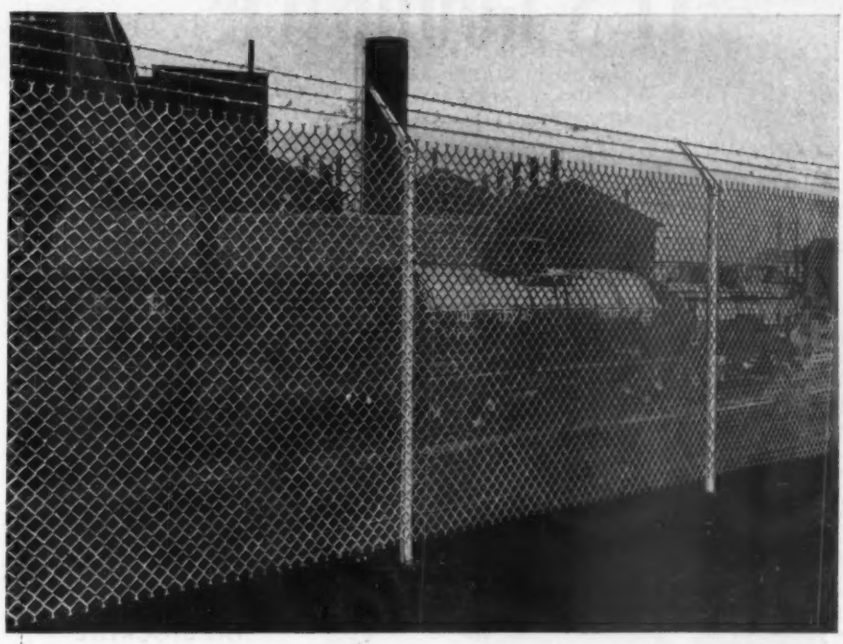
4. To do its full part to prevent or cushion a threatened post-war economic depression, by supporting and following practices which will contribute to the maintenance of a healthy economic life; and

5. To continue to promote, within industry, recognition and fulfillment of the economic and social responsibilities which industrial management shares with other groups for the improvement and advancement of the general welfare.

The Congress of American Industry pledges itself to work for the preservation of America's institutions and the protection of America's future.

Is Your Plant Sufficiently

PROTECTED to Handle DEFENSE ORDERS?



ANCHOR FENCE PROTECTS . . .

Both Inside and Outside of Your Plant Against Saboteurs, Spies

IF YOU are handling Government Defense orders—or expect to—it's time to make certain that your plant, property and personnel are adequately protected against sabotage. It's time to raise a "Wall of Steel" around your plant—to keep out saboteurs and spies intent on destroying or hindering your Government Contract Work. That's Rule No. 1 of sabotage prevention. Rule No. 2 is to raise similar barriers *inside* your plant property, around your power plant, transformer stations, chemical storage, fuel supply and other vulnerable points so that they can only be reached by carefully selected employees. Remember there *may* be potential saboteurs on your payroll right now!

Send for the Anchor Engineer

He'll show you how to guard your property and employees against both *outside* and *inside saboteurs* with a minimum of expense for guards and policing. He'll give you the benefit of Anchor's long experience in fence protection. He'll explain how Anchor Fence *can be moved and reinstalled in case of plant expansion.*

AN ANCHOR ENGINEER will gladly help you plan complete protection for your plant. Write or wire today to the: ANCHOR POST FENCE CO., 6620 Eastern Ave., Baltimore, Md.

for
INDUSTRIAL LIGHTING
IT'S GOODRICH

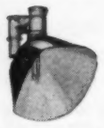
RLM

Goodrich makes all styles including R.L.M.-approved fixtures to meet the most exacting industrial requirements. Where permanence is required, Goodrich fixtures are finished in porcelain enamel.

FLUORESCENT FIXTURES—for high intensity industrial illumination. Many new styles include fixtures for the 100-watt fluorescent lamp.

DISKONECT REFLECTORS—the simplest, detachable reflector ever made. Attached or detached in an instant by means of a simple snap lock.

THE STOCKLITE—for correct illumination of shelves and bins in narrow stockroom aisles. Directs light where needed—eliminates aisle glare—speeds work.



FLOODLIGHTS—for uniform illumination of outdoor areas: a wide selection of styles for long and short range lighting; available for pole or bracket mounting.

STANDLITES—widely used by gasoline service stations, in parking lots, on driveways, station platforms, in fact the industry's most popular fixture for this kind of service.

The above are but a few popular fixtures from the complete Goodrich line. No matter what your industrial lighting requirements may be, Goodrich has the answer. Literature is available on all Goodrich fixtures.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

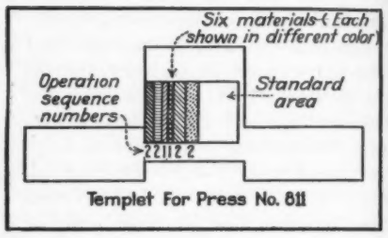
GENERAL OFFICES AND FACTORY: 4604 BELLE PLAINE AVENUE, CHICAGO, ILL.

Management Shorts

(*Continued from page 88*)

ing the operator to determine more readily the terminal points of hand operation.

Those operations in which symmetrical location of bins on right and left-hand side of the operator is necessary, lend themselves readily to the scheme, as the trays or bins containing the same



parts on right and left sides may be colored alike.

Other features of our hand assembly are a special 4 x 2½-ft. assembly table top of a dark brown color, made from a composition material. Swivel elbow rests permit the operator to move her hands and arms more freely and quickly.

•

Pedestrian crossings over the railroad siding in a Mid-West plant are protected by swinging gates on which "stop" signs have been mounted. Normally left across the tracks, train crews must swing gates over crossings before moving trains past the danger spots.

•

PRODUCTION PLANNING AND CONTROL

Save $2,700 by Dropping Unnecessary Inspection

E. H. SCHAEFFER, *Industrial Engineer*
J. E. Ogden Company
Bayonne, N. J.

By applying statistics and common sense to the following frequently met inspection problem, it is possible to reduce costs considerably. The application resulted in a direct labor saving for our company.

There are many cases where 100 percent inspection of small parts is assumed necessary, in order to guarantee

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MAKES THE WEATHER WORK FOR YOU . . .

BOYS—HERE'S TODAY'S WORK!
HEAT . . . DEPT. K, DRYNESS . . .
DEPT. W AND K, COLD . . . DEPT. X,
MOISTURE . . . DEPT. N, CLEAN
AIR AND CIRCULATING AIR . . .
ALL DEPARTMENTS
COLD
MOISTURE
CLEAN AIR
ON THE JOB, CHIEF!
DRYNESS
CIRCULATING AIR

● Heat, Cold, Moisture, Dryness, Cleanness, Circulation — these six characteristics, combined in varying and jumbled degrees by Mother Nature, make ordinary "Weather Conditions."

Now Kathabar — the different air conditioning system — enables you easily to use each of these characteristics separately, or in any precisely controlled combination desired for processing or working conditions in your plant. Each room or department can have its own individual and different atmosphere to suit requirements.

With Kathabar, regulation of humidity and of temperature are simple, separate operations, in no way dependent one upon the other. Kathabar is positive, accurate, dependable, regardless of outside weather conditions . . . Learn more about this modern air conditioning system for modern needs. . . . Let us send you technical and general data.

SURFACE COMBUSTION CORPORATION · Toledo, Ohio

WHAT IS KATHABAR?

Kathabar applies the unique qualities of a chemical called Kathene, the vapor pressure or humidity of which easily can be changed at will. Air coming in contact with Kathene automatically tends to the vapor pressure of the Kathene, thus creating in treated air any desired humidity with absolute precision regardless of weather. Kathene also cleans and deodorizes the air. Kathene is non-inflammable, non-explosive, odorless and inherently harmless. The Kathabar unit is compact, readily accommodated in practically any space and controlled by the simple action of a valve.

- FOR COMFORT—in hotels, restaurants, public buildings, office buildings, factories, stores, theatres and recreation places.
- FOR HEALTH—in hospitals and institutions.
- FOR CONTROLLED DRYING—where materials and their by-products must be dried under controlled conditions.
- FOR SPECIAL ATMOSPHERES—in industries where air conditions affect materials, processes and products.
- FOR DRY BLAST—in cupola and blast furnaces where conditioned air is required in combustion.

FOR 34 YEARS THE LARGEST MANUFACTURERS OF GAS-FIRED EQUIPMENT EXCLUSIVELY

SURFACE COMBUSTION

ALSO MANUFACTURERS OF

SC INDUSTRIAL FURNACES, JANITROL GAS-FIRED DOMESTIC AND COMMERCIAL HEATING EQUIPMENT

EAT in COMFORT ...WORK in PEACE!

Employes' cafeteria in the plant of FISHER BODY CORPORATION, Pontiac, Michigan

This Pick cafeteria is installed in the INTERNATIONAL HARVESTER COMPANY, Chicago

An employee cafeteria makes a plant more efficient, more pleasant to work in—it gives an outlying location desirable convenience, it promotes a friendlier atmosphere between factory and office.

We have built all kinds of cafeterias for industry to fit all sorts of conditions and budgets. To each new plan we bring a wide experience with mass feeding plus an understanding of modern personnel conditions.

IF IT'S FROM PICK IT'S RIGHT

ALBERT PICK CO., INC.
2159 PERSHING ROAD, CHICAGO

• America's Leading Food Service Equipment House.

INDUSTRIAL CAFETERIAS by

• Without cost or obligation, a Pick Engineer will gladly discuss your employee-feeding problem, suggest proper equipment, estimate costs—whether you need modernization of present facilities or a completely new installation.

that defectives will be held below a set figure. Two percent allowable defectives is a nominal expectation in most cases where parts are manufactured or purchased in quantity.

When the unit being considered is an assembly of several component parts, it is impractical in most cases to set the defective maximum on each part below 2 percent; the percentage of defective assemblies may run as high as the number of component parts in the assembly multiplied by the allowable maximum percentage of defectives on each part. Although some of the more obviously defective parts will be discovered and removed during assembly, in almost every case the result is that the percentage of defective assembled parts is above the allowable 2 percent. The thoughtless solution of this is to inspect final assemblies 100 percent.

The following example illustrates a much less costly solution.

One of our products consists of three component parts, each manufactured by a different process and in a different compartment. No department head can be held responsible for defective parts 2 percent or under. While in every case defectives are kept as low as possible, the maximum of 2 percent imperfect is sometimes reached.

An allowance of 2 percent on each three parts gives a total possible number of defective assemblies of 6 percent. Our sales department insits that a 2 percent maximum on defectives be held on all assembled units. Therefore, the custom has been to inspect the final assembly 100 percent. The inspection is accomplished in combination with packaging operation. Eight operators were needed to inspect and pack the parts in sufficient quantities.

In an effort to reduce the cost of the combined inspection and packaging operation, and still keep defectives on final assembly below 2 percent, the following system was developed and successfully installed.

1. The percentage defective (D in the formula below) of each lot of assemblies is determined by inspecting 5 percent of the total pieces in the lot.

2. The number of additional assemblies to be inspected varies with the percentage of defectives determined in (1). For instance, if in a given lot of assemblies inspection reveals a total of 4 percent defective, only 50 percent of the parts placed in each box are inspected. Thus in a box of 100 parts, without inspection four parts or 4 percent would be expected to be defective. However, under this plan 50 percent of these (two pieces) are discovered by inspection and removed, leaving only two parts, or 2 percent, defective, which is permissible.

If 5 percent are defective, then

SIX BIG REASONS

Why New Allis-Chalmers ELECTRIFUGAL PUMP UNIT Gives You *Extra Value at no Extra Cost!*

Here Are Engineering Advancements That Mean More Gallons... At Less Cost to You!

1. **All-in-One . . . Motor and Pump Designed as Unit on One Shaft and One Housing . . . Increases Compactness . . . Adds to Flexibility.**
2. **Allis-Chalmers Lo-Maintenance Motor . . . Developed Especially for This Work . . . Gives Maximum Pumping Efficiency at Lowest Power Cost . . . Built with Cast Iron Frame for Special Applications in Chemical Industry.**
3. **Splash-Proof Features . . . with Air Passages Baffled . . . Safeguard Motor from Liquids.**
4. **Fewer Parts to Wear . . . Better Fit to Parts Because of Fewer Machine Joints . . . Adds to Long-Life, Low-Cost Operation.**
5. **Indestructible Rotor . . . Distortionless Stator . . . Bronze Fitted Pump Parts . . . Large Space Provided for Adjusting Glands . . . and Other Features Assure Improved Performance.**
6. **Greater Stability and Rigidity of All-In-One Design . . . Means Less Vibration . . . Lower Maintenance . . . Longer Life.**

YOUR DOLLARS go farther when you buy the new Allis-Chalmers Splash-Proof Electrifugal Pump Unit . . . with all its *extra-value* features that give you *more* gallons at *no extra cost!*

But we want you to be your own judge. That's why we say — "Take a look at the new Allis-Chalmers Electrifugal Pump!"

Notice the all-in-one compactness, made to beat space waste . . . to give you greater flexibility in installation.

Turn it upside down and see how the air goes in and out, with baffles to prevent splashing into the motor. Take it apart and study both motor and pump, and check over these features one by one.

Then look at the price! You'll be amazed to learn that this new Allis-Chalmers Electrifugal Pump . . . with all its engineering advancements . . . actually costs you no more than ordinary old-style pump and motor combinations.

For the whole story of *all* the extra-value, cost-cutting features you get in the new Electrifugal Pump, call the Allis-Chalmers district office. Or write Allis-Chalmers, Milwaukee, for Bulletin B-6140-5.

A-1301

Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

ALLIS-CHALMERS
MILWAUKEE · WISCONSIN

A TIP FROM TIME FOR '41

CONDULETS

Condulets are the "stand-out" line of conduit fittings because they're the line that stands up in service. When you're wiring a plant for uninterrupted protection they have an importance all out of proportion to their cost. Crouse-Hinds has been building them for long-run satisfaction since 1906.

Condulets reduce installation time, assure a rigid joint with permanent ground continuity. They eliminate the extra tinkering that goes with "almost-fits." They save you troublesome maintenance on joints that vibration might otherwise shake loose.

There are over 15,000 types of Condulets, one to meet every wiring requirement. Each of them brings you the best that's built in conduit fittings.

CONDULETS... *first because of these features*

FINISH
Cast Feraloy — strong, tough, holds shape, resists corrosion, uniform in quality.
CADMIUM PLATED
1st Protective Coat
ZINC PLATED
2nd Protective Coat
ALUMINUM LACQUERED
3rd Protective Coat
TAPER TAPPING
Most permanent and rigid joint — all hubs tapped simultaneously for proper alignment — permanent ground continuity — protection at joint eliminating corrosion — least number of parts.

Condulets are just one of the top-quality lines of wiring supplies you get when you put your requirements up to GRAYBAR. What's more, GRAYBAR stocks help assure prompt service on *exactly* the type and grade of item you want; there's a lot less occasion for buying things that are "almost" what's wanted, just to save time in an emergency.

Write GRAYBAR for full details on Condulet features, or any other wiring supply requirement!

OFFICES IN OVER 80 PRINCIPAL CITIES

Executive Offices:
Graybar Building, N. Y. C.

Everything Electrical
GRAYBAR ELECTRIC COMPANY

$\frac{5-2}{5} = 3/5$, or 60 percent, of the pieces in each box are inspected. In case only 3 percent are defective $\frac{3-2}{3} = 1/3$ or 33 percent of each box are inspected. With 2 per cent defective $\frac{2-2}{2} = 0$ or none of the parts is inspected.

The formula for the above is simple:

D = percentage of total pieces defective within any lot.

N = number pieces per 100 allowed defective (2 percent in this case).

P = percentage of pieces in each package to be inspected.

Then $P = \frac{D-N}{D}$

If P is negative no inspection is needed.

Application of the above system has resulted in a direct labor saving of $2,700 annually. Only five operators are needed because of fewer parts inspected.

•

Found Economical Way to Prepare Installation Instructions

SOURCE

A. B. Dick Company
Chicago

The Okonite Company, Passaic, N. J., manufacturers of electric cable, ran into a problem in getting splicing instructions to the hundreds of workmen who handle their cable in the field. To paraphrase a bit, "a cable is as strong as its weakest splice," and unless a workman has instructions from the cable manufacturer on proper technique for splicing the particular type of cable, weak splices are likely to result.

Obviously, to send a factory-trained man along with each shipment of cable was impractical. A booklet on the technique of cable splicing would have been economical, but the generalization necessary in such a booklet would have rendered it almost completely ineffective because of the special characteristics that make one cable different from another.

Cable splices fall into several different types. By a process of classification splicing instructions were reduced to a reasonable number. That still left the problem of indicating the variables in each case. The only answer to this appeared to be specially labeled diagrammatic drawings to accompany each set of written instructions sent out with every cable.

Here again cost raised its ugly head. To make up a set of new drawings for

Isn't it logical that this "Best-Seeing" Light can be your "Best-Paying" Light?

"50 FOOT CANDLER" *offers...*

1—The "best-seeing" light at less cost
2—Modern appearance
3—30 to 50% lower installation costs
4—Reductions up to 80% in plant wiring system
5—Minimum relocation of outlets
6—Simplified maintenance
7—Consistent lighting performance
8—Easier and quicker installation
9—Allowance for future growth — reduced obsolescence

Investigate Modern Lighting for Your Office, Too . . . Companion-piece to the "50 FOOT CANDLER", *Miller Fluorescent Troffers* represent the most advanced form of continuous recessed fluorescent trough lighting. Write today for new Troffers bulletin Sec. 2G.

EITHER fluorescent lighting can help you increase the present productiveness of your floor space, equipment and personnel, or it can't. Isn't it just that simple?

We look on good fluorescent lighting as a "Fourth Shift" for your factory. That's why the news about IVANHOE "50 FOOT CANDLER" should make so much sense to you. The "50 FOOT CANDLER" is the first RLM continuous fluorescent lighting system providing 50 foot candles of general illumination. This is the illumination lighting authorities prescribe for "best-seeing" conditions in most plants. And even higher lighting levels can be readily worked out where desired.

The "50 FOOT CANDLER", as your "best-seeing" light, can be your "best-paying" lighting investment . . . on the basis of higher illumination at no increase in cost, consistent performance, minimum maintenance and operating expense, and with a plus factor for future growth.

To substantiate these claims, we would like to send you full details about the "50 FOOT CANDLER", or more usefully, make an appointment for you with a Miller Lighting Engineer. WRITE . . . .

THE MILLER COMPANY, Meriden, Conn.
Pioneers in Good Lighting Since 1844

A COMPLETE LIGHTING SERVICE

In addition to Ivanhoe RLM *Continuous* Fluorescent Lighting, Miller offers complete lines of metal reflectors, lighting glassware and fixtures utilizing filament and mercury vapor lamps for all industrial and commercial lighting requirements. A *complete* lighting service — therefore an *unbiased* lighting service.

"50 FOOT CANDLER"

IVANHOE

RLM *Continuous* FLUORESCENT LIGHTING

ILG Proof of results!

Galvanizing Fumes

"TAKE THE COUNT"

WHEN ILG FANS GO ON THE JOB!

IN THE PLANT of Hubbard and Company, Pittsburgh, galvanizing fumes filled the factory building . . . even penetrating the office to impair employee health, comfort and efficiency! *NOW* two Ilg Exhaust Fans prevent these dangerous fumes from entering the office (while supplying frequent *air change* to check "3:00 o'clock slump"). *NOW,* in the plant proper, these harmful vapors and gases are *sucked up,* and *expelled out-of-doors* by six Ilg Power Roof Ventilators. *NOW* employee efficiency is at its peak—production has increased!

Perhaps you have a similar problem? If so, you can profitably investigate Ilg "Vitalized Ventilation"! Write, or phone for a demonstration—*today!*

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2865 N. CRAWFORD AVENUE, CHICAGO, ILL.
Offices in 43 Principal Cities

IN THE OFFICE of Hubbard & Company, two Ilg Exhaust Fans stop fume penetration, provide ideal working conditions for employees.

ON THE ROOF of Hubbard & Company, six Ilg Power Roof Ventilators efficiently pull out harmful galvanizing fumes and stale air from the plant and office.

INSIDE THE PENTHOUSES —are Ilg Propeller Fans, each with exclusive *"Self-Cooled"* miracle motor that *"breathes"!* Offers *low operating* cost of open motor PLUS *protection* of fully enclosed motor. Motor operating parts cannot come into contact with smoke, fumes, or grease . . . Motor *Never "Gums-Up"!*

ILG
Vitalized *
VENTILATION
AND AIR CONDITIONING
*AIR CHANGE...NOT JUST AIR MOVEMENT!

every cable would have been expensive. Printing the drawings with blank spaces for the variables (to be filled in manually for each cable) was out of the question because of the small quantities involved. Blueprinting was possible but not entirely practical.

A photochemical duplicating process proved to be the solution of the problem. Essentially, this process parallels blueprinting: An original line drawing on translucent paper, or tracing cloth, is placed against a light-sensitive stencil sheet; this assembly is exposed to light; the stencil sheet is then developed into a stencil. Unlike blueprinting, however, the resulting stencil is not a final copy but is the source of tens, hundreds, or thousands of black-on-white duplicate copies.

This fitted the problem nicely. For each type of cable splice an ink-line diagrammatic drawing was made on tracing cloth. Only the variables were left blank. From that drawing a photochemical stencil was made from which in turn the required number of copies were run on the stencil duplicator. Then, as each shipment went out, it was a simple matter to fill in the necessary specifications on the drawing, wrap it up with the duplicated text material, and forward to the customer's engineer in charge of the job. In some cases the drawing was fastened to the end of the cable being shipped. Thus workmen on the job are supplied with adequate instruction on how to handle the splicing.

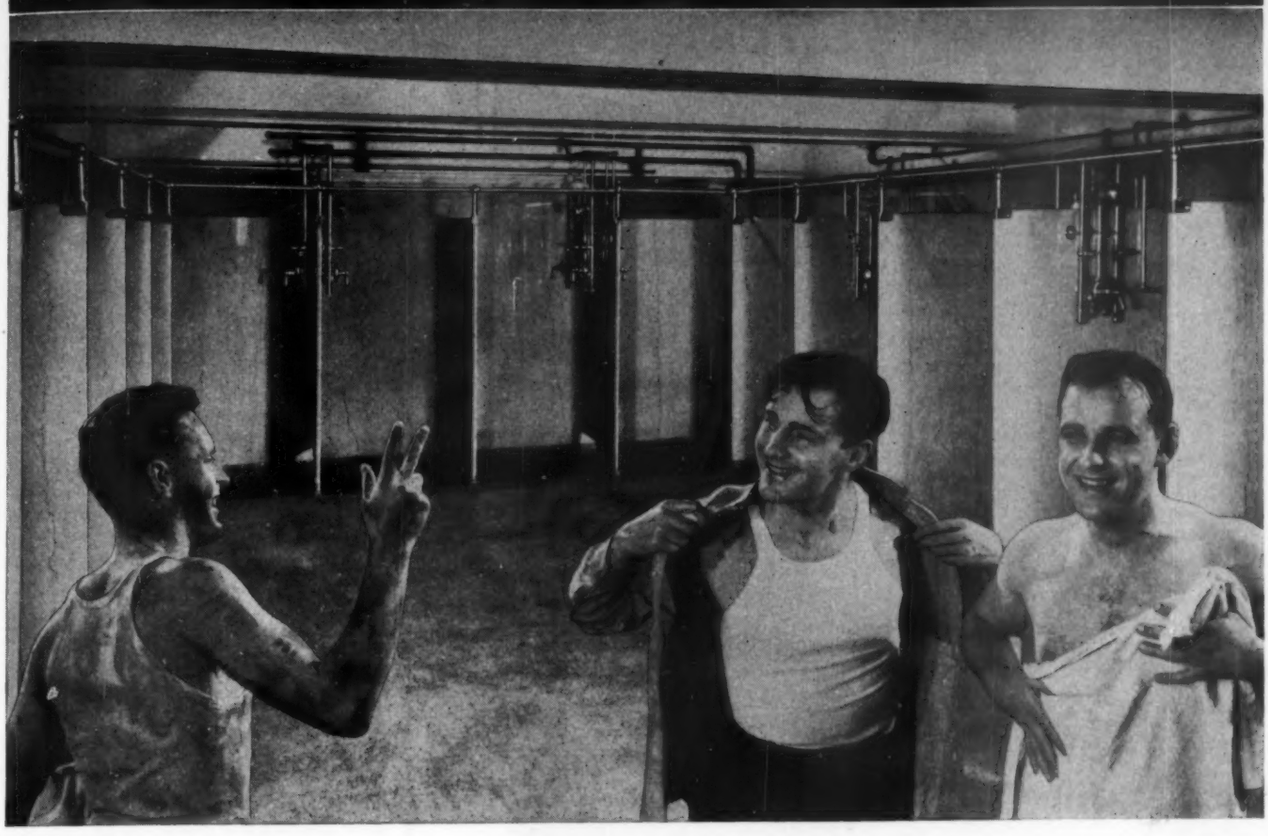
MATERIALS HANDLING

Baffles Push Sand Off Conveyor, Into Bins

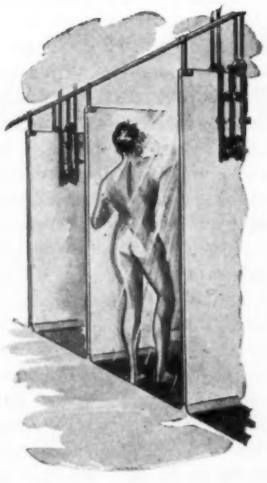
SOURCE
International Harvester Company
Indianapolis

An unusually simple and effective method of diverting granular material from a belt conveyor into several bins as desired, is that used in the sand tower of the new motor truck engine foundry here. Hopper bins to feed the various sandslingers on the molding floor are arranged below, and on both sides of, the belt conveyor that brings sand from the mullers. Hinged to the conveyor frame are several V-shaped scrape-off arms. As the belt brings the sand, the foremost *V* divides it like a snowplow, pushes it off into the two bins beneath this *V*. The workman on this floor, in between jobs of minding more demanding machines, has an occasional look at this belt and the bins. When one pair of bins is pretty well filled, he raises that *V* to an inoperative position, drops the next one —and the next pair of bins begins getting a supply of sand.

Crane Industrial Plumbing . . . *Designed for Durability*



GUARDING THE HEALTH *of Industry's Soldiers...*



TODAY, when industry girds itself for strenuous defense efforts, healthful working conditions are more important than ever. Thousands of new "industrial soldiers" are being mustered into service. To guard their well-being... to promote and maintain their efficiency . . . sanitary facilities must be adequate and correctly designed.

Crane industrial showers . . . lavatories . . . closets . . . urinals . . . drinking fountains . . . are built for today's conditions. Designed to promote employee health . . . to help cut down labor turnover, they have the inherent durability that stands hard use day after day, year after year.

Through your architect or plumbing contractor, Crane can help you plan the kind of plumbing facilities that best fit your particular needs—for modernization or new construction. Get a preview from the FREE Crane Booklet, "Crane Plumbing for Industrial and Commercial Buildings." A copy is yours for the asking.

CRANE

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO

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NATION-WIDE SERVICE THROUGH BRANCHES, WHOLESALERS, PLUMBING AND HEATING CONTRACTORS

It's plain to see . . . why industry is rapidly changing to this outstanding theremometer. Its large, gauge-type scale with bold markings comes right out in the open in matters of accurate measurement (accuracy within 1% over entire scale). You'll appreciate this feature especially on overhead lines, or in other hard-to-get-at places; for readings will be taken in less time, with less effort, and with greater accuracy. Its all metal construction, too, can save appreciably on maintenance and renewal costs. Complete information on types, sizes, ranges, etc., is available in booklet form. Write for your copy, or request the WESTON representative in your vicinity to show you these readable, all-metal thermometers. Weston Electrical Instrument Corp., 628 Frelinghuysen Ave., Newark, N. J.

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FOR OVER 52 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

LABORATORY STANDARDS..PRECISION DC & AC PORTABLES..INSTRUMENT TRANSFORMERS SENSITIVE RELAYS..DC, AC, & THERMO SWITCH BOARD AND PANEL INSTRUMENTS SPECIALIZED TEST EQUIPMENT..LIGHT MEASUREMENT & CONTROL DEVICES..EXPOSURE METERS..AIRCRAFT INSTRUMENTS..ELECTRIC TACHOMETERS..DIAL THERMOMETERS.

They Say and Do

Four Steps for New England

"Our duty is to see to it that New England is fully employed, and that our men, equipment, plants, finances, and managerial ability are all actively and fully applied to the execution of the defense program," said President Ralph E. Flanders of The New England Council at the Governors' Session of the Sixteenth New England Conference. "We can, I am sure, fully apply ourselves to the defense program and coincidentally overcome unemployment, if we take a few definite steps:

"1. Inventory our available labor and plant facilities.

"2. Determine and obtain the work which they can do.

"3. Match this labor and these facilities with the work to be done.

"4. Keep steadily at this program until New England is contributing its utmost to defense production."

•

November Marks New High in Electric Truck Bookings

November domestic bookings of electric industrial trucks and tractors reached the highest point in a number of years, according to figures released by the Industrial Truck Statistical Associations, 208 South LaSalle St., Chicago. A total of 249 units were booked, compared with 193 units in October.

Cantilever-type trucks accounted for 193 units of the total, capacities and base chasses prices of which ranged from 1,000 to 10,000 pounds and $2,025 to $5,255 respectively, with a total net value of $649,968.93. All net values shown are at factories, after additions and deductions for variations from standard specifications, trade-in allowances, etc., when applicable. In addition, there were 17 non-elevating platform trucks, capacities and base prices ranging from 3,000 to 6,000 pounds and $1,660 to $3,035 respectively, having a total net value of $33,074.80; 17 crane trucks, capacities and base prices ranging from 3,000 pounds at 7-ft. to 10,000 pounds at 5½-ft. radius, and $4,980 to $7,450 respectively, with a total net value of $96,770; 16 tractors, capacities and base prices ranging from 200-1,000-lb. to 475–2,000-lb. drawbar pull and $1,300 to $2,595 respectively, had a total net value of $25,190; 5 special non-load carriers and 1 paper roll handler of 4,000-lb. capacity, with base prices ranging from $3,600 to $4,285, had a total net value of $23,000.

Bassick TRUCK CASTERS

SIZES and TYPES FOR EVERY REQUIREMENT

KING PIN *WELDED* TO TOP PLATE. NO LOOSENING AT THIS VITAL POINT

ADJUSTED, HARDENED RACEWAY FOR MAXIMUM QUIETNESS AND EFFICIENCY

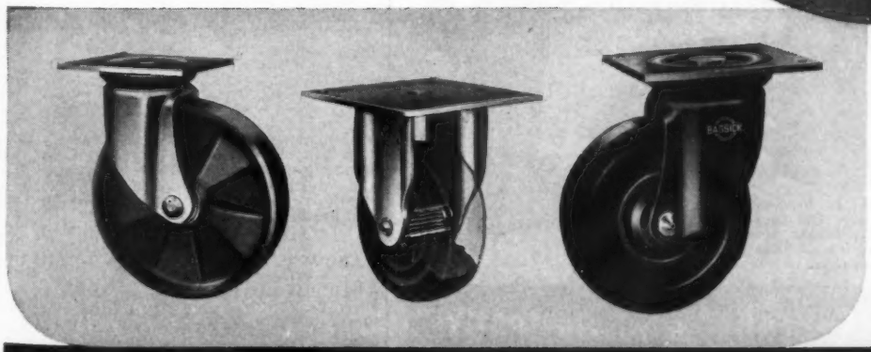
HARDENED BALL RACE AND HORN *WELDED* INTO A SINGLE, INDESTRUCTIBLE UNIT

SERIES "99"

Sizes: 3" 4" 5" 6" and 8"

SILENT STEEL SPECIAL DUTY TRUCK CASTERS

FOR FURTHER INFORMATION SEE OUR CATALOG IN SWEET'S



These are extremely strong, easy-swiveling casters—ideally suited for trucks and equipment where quiet, easy operation is desired. Available with the correct wheels for every type of floor. Write for complete catalog.

THERE IS A BASSICK DISTRIBUTOR NEAR YOU FOR PROMPT SERVICE . . . IT WILL PAY YOU TO STANDARDIZE ON BASSICK CASTERS.

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Canadian Factory STEWART-WARNER-ALEMITE CORPORATION OF CANADA, LTD., BELLEVILLE, ONTARIO

The RIGHT Jack

HELPS MAINTAIN

LOW COST PRODUCTION

Here are two sound reasons why Duff-Norton Jacks are the best jacks for you to buy:

1. From the more than 300 styles and sizes, you are sure to find the RIGHT one for every application.
2. The Duff-Norton reputation is your guarantee of long life and economical operation.

We will be glad to have our nearest Distributor send you a Duff-Norton catalog, or have an experienced jack man call to help you select the right jack for your job!

A FEW OF THE MORE THAN 300 DUFF-NORTON TYPES AND SIZES

This versatile "Jack of All Trades" combines straight lifting, chain lifting, hook lifting and foot lifting. ←

Ideal for low loads in cramped quarters, as well as normal loads, this Automatic Lowering Jack finds many applications. Sizes, 10 to 20 tons. →

Here's one of the handiest jacks of the Duff-Norton line. Compact, easy to carry, fast action, low height jacks are ideal for heavy, low set loads. Sizes 10 to 50 tons, 2½ to 4½ inch raise.

THE DUFF-NORTON MANUFACTURING COMPANY
PITTSBURGH, PA.
CANADIAN PLANT — COATICOOK, QUEBEC
"THE HOUSE THAT JACKS BUILT"

BOOKS

SABOTAGE—HOW TO GUARD AGAINST IT

Harry Desmond Farren. National Foremen's Institute, Inc., Deep River, Conn. 56 pages. $1.

This manual for industrial workers, supervisors, and executives points out the very real menace of sabotage now threatening defense production in this country. It mentions the Black Tom explosion of the last war to show how the tentacles of sabotage stretch forth and cripple output. How foreign agents influence American workers and carry out their work under foreign direction is indicated.

WAGE DETERMINATION

John W. Riegel, Director, Bureau of Industrial Relations, University of Michigan. University of Michigan Press, 311 Maynard St., Ann Arbor, Michigan. 138 pages, illustrations. $1.

Guide to wage policy and wage adjustment contains practical methods of wage determination. Written for executives, this report is based on a survey of methods used in commercial and industrial concerns. The various chapters discuss wage surveys, determination of standard wage rates for key jobs, job evaluation, occupation analysis, valuation of services by the grading method, construction of wage scales, rating plans, compensating the individual employee.

INSTRUCTIONS IN OXYACETYLENE WELDING AND CUTTING PROCESSES

Air Reduction Sales Co., 60 East 42d St., New York. 2 volumes comprising 125 pages, diagrams, tables, illustrations. $1 for lectures, 50c for work sheets.

Series of twenty lectures is intended to broaden the student's knowledge of oxyacetylene processes and insure intelligent application of the manipulative skill he is attaining. It amplifies use of oxyacetylene flame for other services now used throughout industry and includes material on machine gas cutting, description of machines available, flame descaling, flame cleaning and dehydration of structural steel and plate, flame hardening. Group of twenty-two work sheets discusses both theories and practice of oxyacetylene welding and cutting.

MATERIALS HANDBOOK

George S. Brady. McGraw-Hill Book Co., Inc., 330 West 42d St., New York. 591 pages, tables, index. $5.

Fourth edition. For purchasing agents, engineers, executives, and foremen, this encyclopedia of materials met commonly in industry contains general information, with the most commonly used comparative figures, on materials in their group classifications; describes patented and tradenamed materials to give a specific understanding of commercial applications; furnishes data on the chief ores and industrial chemicals. Object is to aid in distinction and selection of commercial industrial materials.

THE TROJAN HORSE IN AMERICA

Martin Dies, Chairman of the House Committee to Investigate Un-American Activities. Dodd, Mead & Co., 449 Fourth Ave., New York. 366 pages. $2.50.

Fifth-column Communistic and Nazi activities in this country, as exposed in the findings of the Dies Committee, are the meat of this report to the nation which does not mince on names, dates, and places. Dies has analyzed the evidence and interpreted it so as to reveal the method and scope of the whole investigation and show the significance of its findings to the reader.

ARC WELDING INSTRUCTION COURSE

Air Reduction Sales Co., 60 East 42d St., New York. 2 volumes comprising 190 pages, diagrams, tables, illustrations. $1 apiece.

First volume consists of twenty lectures on the theory of arc welding. Designed for the guidance of the instructor of a class it begins with a lecture on safety, proceeds to elementary electrical theory and its application to d.c., a.c., magnetism; application of these principles to welding generators and

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operates all types of valves, etc., safely, economically, from
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right angle drives—vertical or horizontal. Wide range of ratios and horsepowers.
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The economical self-contained drive. Horizontal or Vertical types—various ratios and horsepowers.
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All types and sizes of industrial gears. Can be supplied in all materials.

It has been a long standing policy at Philadelphia Gear Works to have a plant equipped with the finest machinery and manned by skilled workers that would enable us to produce gears and speed reducers of all types and sizes of high quality and precision with the maximum possible speed. The maintenance of that policy and all that it entails, makes it possible today for us to answer "Ready" to calls for materials for our country's protection . . . whether it be direct or through other channels that the call may come.

Engineering information about our products sent upon request.

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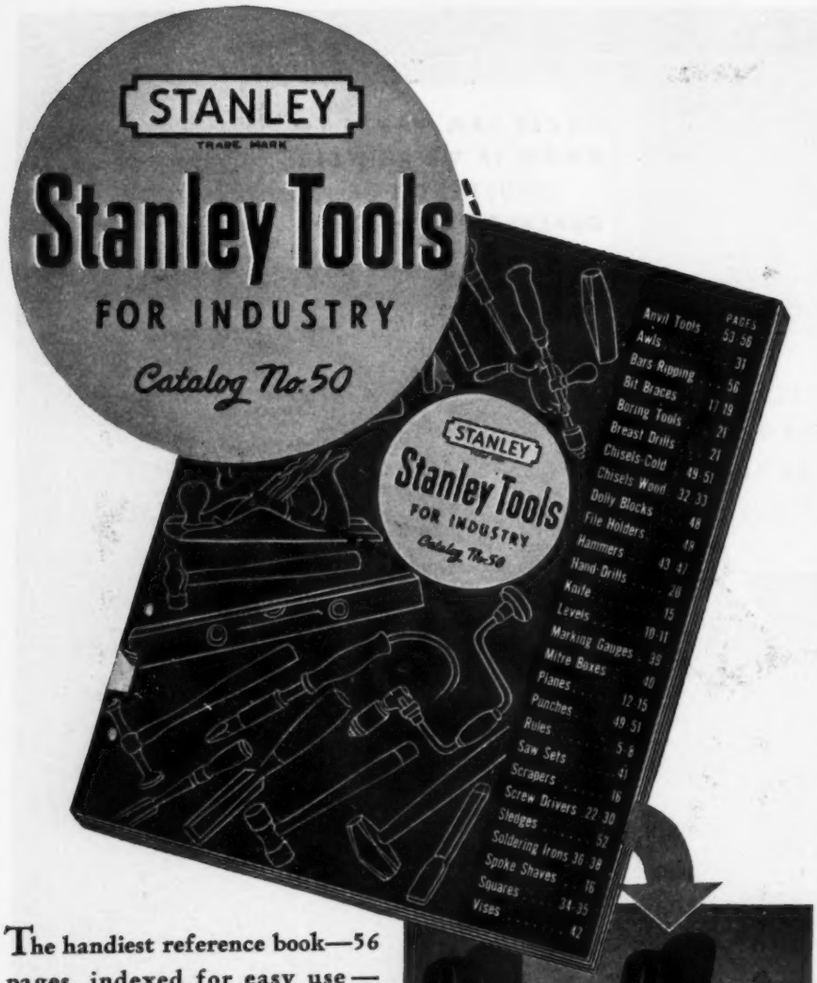

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Typical of the completeness of each classification of Stanley Tools are Screw Drivers. Shown here are a few of over 200 different screw drivers and bits described in this new catalog. Included is a full line of drivers for "Phillips" Recessed Head Screws and Bolts. Your local distributor will gladly supply Stanley Tools to meet your production and maintenance needs.

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transformers; wiring diagrams of welding machines; bare and shielded-arc-type electrodes; discussions of other welding processes, symbols, and nomenclature.

Second volume presents practical fundamental exercises for teaching the various manual operations—technique for application and manipulation of various types of electrodes as well as procedure and method for making different types of welds. Discussion of bare or light-coated electrodes precedes introduction of the shielded-arc or heavy-coated electrodes. Simple standard tests are provided for evaluation of progress made.

TIME AND MOTION STUDY

Stewart M. Lowry, Director of Industrial Relations, Procter & Gamble Co., Cincinnati; Harold B. Maynard, President, Methods Engineering Council, Pittsburgh; G. J. Stegemerten, Staff Supervisor, Time Study and Methods, Westinghouse Electric & Mfg. Co., East Pittsburgh. McGraw-Hill Book Co., Inc., 330 West 42d St., New York. 432 pages, tables, curve charts, forms, diagrams, illustrations, index. $5.

Third edition. Handbook and guide on the principles and methods of time and motion study and formulas for wage incentives. Presents material necessary in developing a practical working system applicable in any industry with the use of simple apparatus that will obtain results and operate with the least amount of interference with production and with the workers' mental attitudes.

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ON THE CALENDAR

JANUARY

6–10, Society of Automotive Engineers, Annual Meeting, Detroit. John A. C. Warner, Secretary and General Manager, 29 West 39th St., New York.

11–13, American Engineering Council, Annual Meeting, Washington, D. C. Col. L. B. Lent, Secretary, 919 17th St., N. W., Washington, D. C.

27–29, American Society of Heating and Ventilating Engineers, Annual Meeting, Kansas City. A. V. Hutchinson, Secretary, 51 Madison Ave., New York.

27–31, American Institute of Electrical Engineers, Winter Convention, Philadelphia. H. H. Henline, Secretary, 33 West 39th St., New York.

FEBRUARY

17, National Electrical Manufacturers Association, Midwinter Meeting, Chicago. R. J. Blais, Convention Manager, 155 East 44th St., New York.

MARCH

24–29, American Society of Tool Engineers, Machine Tool and Progress Exhibition, Detroit. Ford R. Lamb, Executive Secretary, 2567 West Grand Blvd., Detroit.

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Factory Management and Maintenance is a consolidation of *Factory and Industrial Management* and *Maintenance Engineering.*

Factory and Industrial Management grew from consolidations, mergers, or absorptions involving the following publications: *The Engineering Magazine; Industrial Management; Factory, the Magazine of Management; Management Engineering; Administration; Management and Administration; Management and Administration in Manufacturing Industries; Manufacturing Industries.*

Maintenance Engineering grew from consolidations, mergers, or absorptions involving the following publications: *Review of the Telephone and Telegraph; Electrical Review; Western Electrician; Electrocraft; Electrical Engineering; Electrical Review and Industrial Engineer; Industrial Engineer; Industrial Engineering; Industry Illustrated.*

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